Eurobarometer Qualitative Study

PUBLIC OPINION ON FUTURE INNOVATIONS, SCIENCE AND TECHNOLOGY

National Report

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France

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Eurobarometer

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Public opinion on future innovations, science and technology: results of focus groups in selected Member States

National Report

France

Conducted by TNS Qual+ at the request of
the European Commission,
Directorate-General for Research and Innovation

Survey co-ordinated by the European Commission,
Directorate-General for Communication
(DG COMM "Strategy, Corporate Communication Actions
and Eurobarometer" Unit)

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EXECUTIVE SUMMARY

General perceptions about scientific and technological innovations

- In general, French participants demonstrated **deep ambivalence towards scientific and technological innovation**: each positive mention was linked to its downside, the "other side of the coin".
- **The assistance and independence** offered by innovation are therefore contrasted with **dependence** and dependence on machines. The development of means of communication is likewise accompanied by further **isolation**. Likewise, although innovation **creates jobs** in new sectors, it also **destroys them in others**. More broadly, the **speed and efficiency** brought about by technological developments are also perceived as being **sources of stress and pressure**.
- However, it is not so much innovation itself that participants described as being disturbing or threatening as **the behaviours and social changes it produces, accelerates and reveals**.
- Overall, a tension was observed in the groups between:
    - a genuine curiosity and appetite for innovation,
    - acceptance by most of innovation, which is seen as inevitable: people need to adapt,
    - and a desire by a minority for this relentless race towards innovation to stop or slow (especially among older participants, who also often mentioned their fear of being left behind).

- All of the participants said that **technologies linked to the digital and mobile revolution were those that had transformed society the most over the past few years** (widespread adoption of the internet, mobile phones and mobile internet access): particularly rapid changes that have affected the entire population and all aspects of daily life, both at work and home.
- As such, both the positive and negative aspects of these changes were mentioned:
    - Among the positive items: simplification and help in daily life which we could not do without, increased interaction with those close to us.
    - But there is a feeling that the ubiquity of technology makes us dependent, that increasing the quantity of contacts is sometimes achieved at the expense of quality. In addition, risks in terms of personal data protection are also mentioned.

- Other areas were also mentioned as having benefitted from many innovations: the health sector in particular (where progress brings enthusiasm and hope) as well as transport and housing (with recent developments in home automation and connected devices).

Spontaneous projections on tomorrows' scientific and technological innovations

- Spontaneously, participants believed in particular that the next 15 years would be marked by **extensions to or the widespread adoption of existing technologies**. They did not mention any new needs that would require specific scientific or technological innovations.
- Although healthcare is a sector where positive impacts are particularly awaited, participants were especially hopeful that the innovations developed truly would benefit mankind.
- However, they highlighted **many risks linked to technological development**: isolation and de-socialisation, environmental disasters, the enslavement of men by machines and total dependence on technology.

- In housing, home automation was described across the board as likely to become widespread in the coming years: the benefits **for sick or dependent people** were particularly emphasized. However, the fear that one could become **helpless in the event of an outage or hacking** is also mentioned, as well as **the anticipated cost of these innovations**.

- In healthcare, **participants hoped for an increase in life expectancy in good health** and improved pain control. As for innovation, they mainly mentioned the replacement of missing body parts or tools that would allow the deaf or blind to regain the use of their senses. Concerns regarding possible instances of mishandling (manipulation of living beings, genetics) were also expressed.

- In communications, participants anticipated **the development and widespread adoption of existing equipment as well as the behaviours associated with them**: they said they fear the increasingly virtual nature of exchanges and the decrease in real interaction between people. In particular, the French participants we met seem to dread the contemporary exacerbation of individualism.

- On the environment, participants did not mention actual innovations but concentrated on the increasingly widespread adoption of existing technologies, especially individual and collective behaviours (the development of waste sorting, organic farming, more responsible consumption in particular). **Scientific innovations and technology were indeed more spontaneously perceived as threats to the environment** rather than solutions that will help protect it.

Reactions to future scientific and technological innovations in selected areas

- **Housing and everyday life:** participants were largely divided about this scenario. A majority of them had negative perceptions and criticisms. Of course, the practical aspect of the innovations was praised, as was their usefulness for elderly and dependent people. These judgments were nevertheless largely offset by participants' strong negative feelings about innovations that could pose a potential danger (piracy, lack of protection of personal data), lead to a sense of dispossession and intrusion, encourage a dependent culture and laziness and ultimately reinforce reliance on technology. As such, the Personal Robot Assistant provoked rather negative reactions, with participants fearing a loss of control of their environment as well as their ability to make decisions.

- **Health and healthcare services:** participants' reactions to this scenario were rather divided and varied between a belief that health management will improve in the future (through screening and prevention) and concerns about the commercial aspect and the role played by supermarkets. Furthermore, some considered the scenario likely to cause anxiety, fearing that the monitoring and control of each individual's state of health will lead to paranoia or hypochondria. Nevertheless, most of the innovations presented (especially biochips and therapy using stem cells) sparked a genuine interest.

- **Virtual communication and interactivity**: this scenario was held to be both realistic (as it resembles the current situation) and extremely scary, foreshadowing a dictatorial and totalitarian state. In this regard, participants expressed some resignation to this future which they believe to be probable. With the exception of virtual reality tools such as holograms - which are considered beneficial - most of the innovations presented were rejected from the outset. However, after some consideration, some of them were deemed to be acceptable if they can provide a personal benefit (e.g. fighting crime). There is nevertheless genuine distrust regarding the use of personal data by commercial businesses, and therefore high expectations in terms of reinsurance and safeguards.

- **The environment:** spontaneously, participants responded positively to this scenario, which they felt depicted a desirable future. However, it was also considered to be quite unrealistic because it would need willingness on the part of political and economic leaders as well as newfound awareness among all citizens. Although innovations related to homes, recycling and energy savings were very well received, tools for agricultural practices and geo-engineering techniques were received rather sceptically or critically because they do not really seem to provide better protection of the environment.

A. OBJECTIVES AND METHODOLOGY

Objectives

The aim of this qualitative study was to get a better understanding of European opinion on the subject of innovations brought about by science and technology in society. More precisely, its main objective was to explore reactions to some specific innovations that might be a part of everyday life for citizens in Europe in 15 years' time in four different areas.

Four areas/scenarios were tested:

- The house of the future (Homes and living),
- Health and healthcare,
- Communications (Ubiquitous communication and interaction),
- The environment.

Methodology and sampling

Fieldwork consisted of a series of 6 focus groups, each approximately two hour and a half in length, conducted in each of the following 16 Member States: France, Denmark, Germany, Estonia, Greece, Ireland, Italy, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Finland, United Kingdom and the Czech Republic.

Participant profile

The table below presents the composition of groups:

Group	Description
1	18-34 years old who finished their education between 17 and 22
2	20-34 years old who finished their education between 20 and 25
3	35-64 years old who finished their education before 18
4	35-64 years old who finished their education before 18
5	35-64 years old who finished their education after 18
6	35-64 years old who finished their education after 18

The detailed participant profiles and group composition, as well as detail on the fieldwork dates are described in the technical report.

National context

We did not observe any news related to science or technology specific to France which had emerged before the group meetings.

We must just note the country's persistent economic difficulties, the serious concerns the French have about unemployment and, more generally, their pessimism about the country's future.

These facts may partly explain the rather negative expectations the participants have about society in the year 2030 and, more specifically, the many statements portraying scientific or technological innovation as a reason jobs are disappearing.

However, beyond the pessimism of the French about their country's situation, we observe – among a growing proportion of the population – an interest in everything relating to innovation and local initiatives (fabrication laboratories, for example) and new forms of consumption or interaction (collective buying, person to person services, etc.) These initiatives, which lie outside the institutional system, are ways to individually cope with the crisis and express values of proximity and autonomy.

I. GENERAL PERCEPTIONS ABOUT SCIENTIFIC AND TECHNOLOGICAL INNOVATIONS

This chapter focuses on the participants' general view on scientific and technological innovations in order to get an overall grasp of their opinion on this subject. Firstly, what **ideas, feelings and associations** come to their mind when thinking about these innovations? What **positive and negative aspects** do they tend to associate with innovations brought about by science and technology? Secondly, **looking back on recent years, which innovations do they think have had the most impact on society and why?** What **changes** did these scientific and technological innovations bring?

1.1 General associations linked to the notion of scientific innovation

Overall, participants displayed a high level of ambivalence about scientific and technological innovation. Within each group - but also for most individual participants - spontaneous associations were both positive and negative.

Participants spontaneously mentioned:

- fields where innovation is widespread: transport, research, medicine, etc.
- examples of innovation: 3D printers, smartphones, etc.
- and above all the impact - positive or negative - of these innovations on themselves or on society as a whole.

Each positive perception among their statements was balanced by a downside, a "flip side". Participants also recognise the high level of ambivalence they feel towards science and technology, a source of both hopes and fears.

"Curious, amazed, astonished, we feel overwhelmed, insignificant, worried, where do we stand, values and landmarks lost" (France, group 3)

"Nature is at risk, loss of employment, unemployment, man and machine" (France, group 5)

A) Help versus dependence

As far as the positive points, **the assistance provided by technological innovations** in everyday life was very often mentioned.

- Innovations in information, computing and new technologies were mentioned particularly often. They provide more autonomy, simplification of administrative procedures and easy access to all kinds of information: valuable assistance in everyday life that would be difficult to do without.

However, this positive aspect was offset by **the fear of becoming totally dependent on these technologies**: the risk of losing independence or skills by relying too much on new technologies (e.g. relying solely on a GPS rather than learning how to find your way).

- Participants mentioned their fear of **being totally helpless in the event of a "blackout"**: in this scenario, individuals would be unable to regain the expertise and skills that had been replaced by machines.
- According to some, the assistance provided by these technologies could also lead to **dependency**, and even **idleness** which they condemned.

"The internet simplifies daily tasks. We can check our bank account, we can see which subway line we need to take. That's right, thanks to the internet you can have online banking, no need to pay unnecessary charges any more. With the internet we can break monopolies, everything to do with electricity, etc. With access to information, you can stay informed. Easy for consumers." (France, group 5)

"It's for our well-being, to make life easier, it will help us in daily life. It's fast and convenient, we have information, everything we need." (France, group 2)

B) More communication versus isolation

For most participants, new technologies have also allowed **communications to be simplified and improved** between people, making it almost banal to maintain regular contact with the other side of the world. They have therefore created a certain **openness to other people and places**.

However, the growth of the internet, phones and social networks have also paradoxically led people to **turn inward**:

- The virtualisation of contacts (SMS, emails, chats...) leads to the depersonalisation of human relationships and the loss of simple and "human" exchanges with friends, family or neighbours.
- Exponential growth in means of communication does not prevent **the development of feelings of isolation or loneliness**.
- To a lesser extent, some believe that interaction on the internet leads to forms of "communitarianism", withdrawal into like-minded groups, while the anonymity permitted by the web would encourage the unleashing of hatred and verbal abuse.

"It opens people's minds, broadens their horizons regarding new things, new areas" (France, group 1)

"It creates links with people we don't know, we communicate faster and more easily. We are all connected, we're able to get in touch with people we haven't seen in years." (France, group 2)

C) Job creation versus job losses

Participants mentioned innovation and science as dynamic sectors that create jobs and are **drivers of growth** for the economy (e.g. start-ups).

However - and especially for older participants - **innovation was also blamed for job losses**: it involves relentless adjustment by workers, which can be a burden for less skilled or older workers, who may easily feel left behind.

- For this reason, the example of supermarket cashiers who are replaced by self-service tills was very often mentioned by participants, who regretted their widespread adoption while admitting to using them.

"Fewer jobs, things are increasingly automated, less labour" (Group 1)

"Self-service tills are a bad thing, jobs are being eliminated." (France, group 1)

D) Speed and efficiency versus stress and pressure

New technologies also bring more speed and fluidity to work and interactions between people. They also enable advances that would have been unthinkable a few years ago.

But most participants felt that **ceaseless innovation also leads to a world where everything goes too fast**: they highlighted the stress and pressure that are generated by immediacy, instantaneousness, the need to stay connected and having to respond faster and faster to an ever-increasing number of demands.

- This aspect was especially highlighted by the older participants: some said they felt or feared that they are being left behind by constantly evolving technological tools. Although not as "lost" as the older participants, the younger ones were just as critical or concerned about this perceived acceleration of time.

"Pressure of not understanding, of feeling left behind." (France, group 4)

"Too quick, fast, convenient, dangerous. Uncertainty about the future. A lack of adaptation. Constant discovery. Marginality: if we're not up to date, we're on the sidelines." (France, group 6)

E) Medical progress versus ethical abuses

Although spontaneous associations regarding the health sector were very often positive (advanced treatments, living longer, technical expertise, etc.), there were still **fears about the abuse enabled by medical progress**: cloning, eugenics, etc.

Ultimately, the innovations brought about by science and technology are seen as being both:

- **Synonymous with improvements** in living conditions, quality of life...
- But also a sign of **degradation**: innovation notably leads to an acceleration of time, increased stress, the loss of the simple relationships between people and therefore a certain **dehumanisation**.

It is not so much innovation itself that alarmed participants. It is the attitudes and social changes it produces, accelerates or reveals. Thus, it is not the technologies themselves that are deplored, but rather their use and their impact on human relationships or work: for example, the ubiquitous use of mobile phones which violates basic rules of courtesy and community life.

- Some technologies, however, were mentioned as being disturbing in themselves: GMOs, electromagnetic waves, cloning, etc.

"Radio waves: among our teens in France, one out of every I don't know how many teenagers gets brain cancer. They don't tell us. There are associations working on it. People near their TV, their microwave, receive radio waves. This is extremely serious. This is a public health issue. We see fewer and fewer swallows in the sky, because of electromagnetic waves." (France, group 5)

We also found that **the socio-economic aspect of innovation** was often spontaneously highlighted by participants, who mentioned that it can also create or expose social inequalities:

- The richest benefit the most from technological innovations and the additional comfort they provide.
- Technological devices had therefore become an outward sign of wealth.

"Social status: you are defined by the gadgets you own." (France, group 6)

"Increased inequality, only the truly wealthy would be able to afford vaccines, operations, and who will control technology as a whole." (France, group 1)

Overall, and regardless of positive or negative perceptions, participants demonstrated a certain **fatalism about progress and innovation**, feeling largely like spectators, both fascinated and scared. Whether they benefit or suffer from this progress, they cannot escape it: this reflects a lack of control over their lives.

There was **tension within the groups between various positions**:

- **Genuine curiosity and appetite** for all kinds of scientific and technological innovations.
- **Acceptance** – cheerfully enough - **of progress and the need to adapt to it**: progress is inevitable, it is futile to resist it. Participants said that this was shown by the history of science and technology.
- A minority **wish the relentless charge for innovation would stop or slow down**, as they feel it makes no sense and did not improve life.

"It's less human when it comes to robots, it eliminates the human side, and genetics, that can be bad, if you start tampering with genes. It can make us dependent, like with GPS in the car, no one knows how to read a map anymore! The day computers no longer work, no one will know how to do anything." (France, group 1)

"Human beings are too dependent. Everything's digital. Nothing but computers. We only communicate through Facebook and text messages." (France, group 5)

"We have lost some quality of life, in the insurance business there are sensitive cases, but we're under so much pressure. On public transport people are bitter, there is a great deal of aggression: there is progress (medical) but also lots of regression." (France, group 4)

"Left behind, a hard time adapting. We're chasing something that is already obsolete. We're turning into robots. Losing our values, our sociability." (France, group 6)

1.2 The most important scientific and technological innovations observed over recent years

Participants spontaneously cited a very large number of innovations developed in recent years.

- Some were very recent: 3D printers, drones, robot vacuum cleaners, Google Glass, exoskeletons, etc.
- Even those expressing little interest in science and technology showed that they have some knowledge of these innovations, proof that these inventions continue to make an impression, to surprise or shock.

Across all the groups, participants all said that **the technologies of the digital and mobile revolution** were the ones that had **transformed society the most** in recent years: widespread adoption of the internet, mobile phones and mobile internet access (using 3G and then 4G).

- Because everyone is affected by these changes: even older people have to keep up with them.
- Because these changes have an impact on various aspects of daily life (transport, shopping, travel), as well as family and working life.
- Because these changes have been particularly rapid, leading to changes in behaviour and habits that would have been unimaginable a few years ago.

As for scientific and technological innovations as a whole, participants mentioned **both positive and negative aspects of these changes**.

Positives identified were:

- the simplification, speed, help with daily life provided by these innovations (online processes, GPS, etc.),
- increased interaction with friends and family, especially those who live far away, thanks to social networks,
- easy access to both knowledge itself (Wikipedia), entertainment (YouTube, online games) and practical information (consumer advice, choosing a restaurant, ordering tickets online).

But they also deplored the **negatives**:

- the pervasiveness of these new technologies and their impact in terms of pressure and stress (the need to be highly responsive, to answer emails quickly, etc.),
- the fact that the increase in the quantity of contacts could have an adverse effect on their quality: the virtual nature of communication loses a human dimension,
- risks relating to the protection of personal data: fraud, identity theft, the impression that we're constantly being monitored and examined.

"Everything that relates to privacy is happening right now, we're connected everywhere, there's a great deal of access to our personal data, our bank accounts." (France, group 1)

"There are positives and negatives: you can talk to family far away. But people who live close to each other use this technology to do everything using the internet, without seeing each other. There is loneliness despite it all, we're alone with our phones. Individualisation." (France, group 4)

"I'm a bit scared when I see young people staring at their phones, too. Young people don't talk to each other any more, they're texting each other. We're losing our values, our sociability." (France, group 6)

"Job hunting on the internet. Government departments, you access them through the internet. Everything is done through the internet." (France, group 3)

"The internet is great for job hunting, and for distance working as well." (France, group 2)

"Isolation, phones are increasingly sophisticated, we're isolating ourselves, and we're less open to the world. We're open in a virtual sense." (France, group 1)

Meanwhile, other areas were also mentioned as having seen many innovations:

- **Health:** the innovations mentioned here were almost exclusively positive: advances in the treatment of serious diseases (cancer, HIV, etc.) and in transplants, remote surgery. Participants emphasised the great progress made in this area.

- **Homes and accommodation:** the development of home automation and connected objects was mentioned in all groups. Although participants emphasised that these innovations were still underdeveloped, they expect rapid progress in coming years. Energy savings and efforts to make homes less reliant on energy were also cited.

- **Transport:** progress in public transport mas mentioned: faster, quieter, safer (high speed trains, in particular). For motor vehicles, they often mentioned the development of electric and hybrid cars and intelligent cars (more electronics and automation).

- **Work:** innovation was mentioned in two contrasting areas:
    - the positive development of teleworking, made possible by digital technologies,
    - and the negative, job losses due to the replacement of men by machines.

- **Environmental protection:** participants mentioned the development of clean energies such as wind turbines and solar panels but struggled to come up with innovations that have a direct impact on the protection of the environment.
    - The main new development mentioned in this field was waste sorting, even though this is not really a scientific or technical innovation.

- **Lastly, education:** innovations are perceived as being more limited in this area. A few mentioned the growth in digital tools such as tablets in schools or the development of distance education (Massive Open Online Courses were mentioned once). But these changes still seem to be rather anecdotal.

"We started out with nothing. And now we've reached a level of technology, a decade ago we would never have imagined it." (France, group 1)

"(The innovations that have transformed society the most?) Computers, telephones, communications." (France, group 4)

"Energy savings? Using robotics in a home, for people with disabilities. Solar panels." (France, group 4)

"Robot vacuum cleaners, which work on their own." (France, group 5)

"It brings comfort, it relieves human trouibles. In medicine it's remarkable. Reassuring, it's all better at every level, quality of life, longevity." (France, group 3)

II. SPONTANEOUS PROJECTIONS ON TOMORROWS SCIENTIFIC AND TECHNOLOGICAL INNOVATIONS

This chapter focuses on participants' spontaneous predictions about the scientific and technological innovations that could be part of daily life in 2030, which changes are seen as beneficial and those seen as more negative or undesirable. Finally, it looks at the scientific innovations in four selected areas:

- How living at home will be different in the future;
- how people will take care of their health;
- how people will interact with each other and with machines;
- and how people will protect the environment in 2030.

2.1 The scientific innovations expected to be part of peoples' daily life in 2030 and their possible impact

When asked to look forward 15 years, participants generally imagined that what they have observed in recent years in terms of innovations would continue (without necessarily accelerating).

Some innovations were therefore mentioned which were most often **extensions or spread of technologies already discussed**:

- Fully automated cars without drivers,
- Development of augmented reality, 3D video conferencing,
- Increasing use of 3D printers,
- Development of nanotechnology (e.g. to create smart materials or textiles),
- Development of connected objects, especially in homes, along with the increased use of voice-command systems,
- Contactless payments, especially via mobile phones.

These are therefore largely a continuation of existing innovations: the participants did not bring up any new needs that would call for scientific or technological innovations.

To a lesser extent, some mentioned innovations (drawn from the world of science fiction) that are considered to be less credible: flying cars, teleportation in particular.

Health is one sector where benefits were often mentioned by participants: treatments for cancer, new vaccines, treatments tailored to the specific needs of each patient, improved pain management, increased prevention, particularly through a better understanding of each person's risk of developing diseases, etc.

In an ideal technological development scenario, participants mainly hoped for the development of **innovations that serve mankind**, i.e. improving quality of life, mainly through innovations in health and environmental management, without threatening jobs.

However, participants foresaw **many risks** in a worst-case technological development scenario:

- Technologies that lead **to isolation, to de-socialisation**. According to some participants, the ability to do everything from home over the internet (social life, shopping, work, etc.) could lead to a form of dehumanisation.
    - At the same time, the development of information technologies and the recording of personal data could threaten the very idea of privacy.

- The fear of **environmental disasters** due to overexploitation of resources and technological accidents (e.g. nuclear risks).

- The 'robotisation' of society. The participants expressed their fear that **increasingly advanced automation** would lead to job losses and, more generally, to the replacement of people by machines: what room is there for people in this technology-driven world?
    - The most imaginative participants also feared that robots would seize power over humans in a scenario reminiscent of science fiction stories.
    - These fantasies - expressed by only a minority of participants - nevertheless reflected the rather widespread fear that **technology no longer serves mankind** and that humans are therefore excluded and have more to lose than gain.

- At the same time, some participants feared that **the pervasiveness of technology in daily life would drag people down into dependency**, preventing them from freeing themselves from machines.
    - In the most extreme projections, some participants described future humans as shapeless masses managing everything from remote locations and content just to eat and sleep.
    - Others expressed their fear of an abrupt return to the past if one day all these technologies 'broke down'.

- To a lesser extent, some participants questioned the very future of mankind: fearing the effects of genetic manipulation or referring to trans-humanism.

"Electromagnetic pollution. Human cloning." (France, group 6)

"We're going to be eating new fruits, new vegetables, with GMOs." (France, group 3)

"An elitist world: only a small group of the wealthy will be able to enjoy things." (France, group 5)

"We're going do even less, everything will be automated, this will increasingly be the case. The driverless car, we're going to ride without driving." (France, group 1)

"In medicine, we'll succeed in examining genes inside the foetus, to prevent the child from being ill, or to give it exceptional abilities." (France, group 1)

"I think it's called 'macrotechnology', or micro, it's really tiny, with this technology they are able to make screens as thin as a sheet of paper, and also smart fabrics that change colours, it's totally evolving, lots of things we can't even imagine yet." (France, group 1)

"There is a risk that we will become slaves to our own technologies." (France, group 2)

"Flying cars! All new apartments will be equipped with home automation systems. 3D printers will enable us to replace missing or broken parts without having to order them. We will no longer produce objects in the same way. I heard that there is a 3D printer that enables you to build a two-floor house in one day." (France, group 2)

2.2 Expected innovations in selected areas

Homes and living

In the domestic field, home automation – which was often spontaneously mentioned among recent innovations – was described in all groups as increasingly widespread in the years to come:

- The development of connected objects,
- The ability to control the home's heating or open the shutters from a remote location,
- The spread of voice commands.

The oldest participants emphasised **the benefits that home automation can provide for sick or dependent persons**, and more generally the development of housing to support people with reduced mobility.

Improvements in security were also mentioned: remote monitoring, motion detectors, doors controlled by fingerprint or iris recognition systems.

The idea of domestic robots was also spontaneously cited as a logical extension of existing single-task robots.

The prospect of more environmentally clean homes (built with natural materials, more energy efficient, or producing their own energy) was also discussed but with some scepticism about widespread adoption.

On the negative side, participants also voiced a certain number of fears:

- The fear of being **largely helpless in the event of a breakdown**, of no longer knowing how to do everyday tasks,
- **The risk** that systems could be **hacked** by malicious people,
- **The cost** of home automation equipment, which would probably only be within the reach of the wealthiest,
- **The risk of isolation**: homes which are nearly self-sufficient, where you can do everything remotely from a screen.

"A robotic society. Automation. Loss of personality: all this robotic stuff pushes us away from human beings. No manual labour." (France, group 5)

"Green neighbourhoods. Household appliances: everything will meet a certain energy consumption threshold while providing good performance. The air will be more breathable." (France, group 2)

Health and healthcare

Participants' aspirations and expectations on healthcare and its management were fairly clear, even though the scientific or technical innovations required to achieve them were not known or identified:

- Increased life expectancy in good health,
- Improved pain management.

Some innovations were nevertheless mentioned:

- the replacement of missing organs using 3D printers or related technologies,
- tools that enable people to regain a lost sense, such as glasses for people with visual impairments connected directly to the nervous system,

- highly localised surgical procedures that do not require a major operation or anaesthesia,
- and to a lesser extent:
    - computerised medical records that would allow healthcare professionals to access all of a patient's medical history,
    - remote consultation by health professionals.

Although negative expectations on healthcare were not often spontaneously cited, when prompted, **the participants expressed fears**:

- **about overpopulation** if life expectancy continues to increase with the problems that arise in a world of limited resources,
- **about a growing cult** of youth and aesthetic perfection, if medicine allows us - for example - to replace aging organs,
- **about the development of genetic selection** and eugenics (they fear cloning and, to a lesser extent, the manipulation of stem cells).
- **about rising inequality** in access to care and the risk of "two-speed medicine".

"Innovations in medicine to prolong life." (France, group 6)

"We'll live for a long time. They will be able to perform operations that are not currently possible. For those who are 100% deaf, there will be a system that allows them to perceive sounds. The same goes for eyes: there will be a camera that will enable the blind to see." (France, group 1)

"Rebuilding organs, limbs, which no longer existed, recreating them... The ability to perform a transplant on any part of the body." (France, group 1)

Ubiquitous communication and interaction

Participants mentioned few specific communications innovations (with exceptions including 3D and hologram-based remote video conferencing systems).

Instead they envisioned **the development and increasingly widespread use of existing devices** and as a result the behaviours linked to them:

- less physical interaction between people,
- an increasing number of text messages, messages on social networks: lower quality communication between people,
- a generalised virtualisation of human relationships, which would also be reinforced by teleworking.

Meanwhile, some participants expressed a fear that they would increasingly have to deal with machines or robots in day to day business (shopping, administrative formalities, etc.) at the expense of "humans" and "meaning"."

Across these examples, **French participants seem above all to fear an exacerbation of contemporary individualism**: in the future, people will live behind a screen, in a bubble, connected to the rest of the world only via the internet and cut off from immediate and tangible reality as a result.

"I'm afraid we're going to become slaves of our own technology." (France, group 2)

"We'll be able to dissect other people's text messages and emails." (France, group 2)

"We'll be able to communicate with a sort of 3D phone, like with Skype. Using holograms." (France, group 6)

"We will be increasingly isolated. There will be intrusions into our privacy. This already exists with hackers, credit cards and other data... The dark net exists for piracy." (France, group 6)

Environment

On the environment, participants mainly raised these issues:

- **The increasingly widespread use of cleaner cars**: the elimination of diesel, increasing numbers of electric or hybrid cars.
- **The development of renewable energies**.

Participants did not generally mention innovations as such, rather the increasingly widespread adoption of existing technologies and especially individual and collective behaviour, which they say will be in a better position to ensure proper environmental protection, e.g. the development of sorting of waste, and organic farming.

- Taken as a whole, participants do not spontaneously think that scientific and technological innovations would help protect the environment: this would depend above all on everyone's behaviour, especially in terms of consumption.
- New technologies - which rely on expensive raw materials - are therefore perceived more as being a threat to the environment in the broad sense: water, air and soil pollution, electromagnetic waves, etc.

Therefore, because they are more or less consciously associated with the dominant model of economic development, **scientific and technological innovations are perceived as threats to the environment rather than something that can protect it**.

"Clean and green cities, planted roof terraces. I hope this will take over cities. Electric cars already exist, as do electric buses. Household appliances are intersecting with each other, this will produce savings. Solar panels." (France, group 2)

III. REACTIONS TO FUTURE SCIENTIFIC AND TECHNOLOGICAL INNOVATIONS IN SELECTED AREAS

The main objective of the study was to explore reactions to some specific innovations that might be a part of everyday life for citizens in Europe in 15 years' time in four different areas.

- The house of the future (homes and living);
- Health and healthcare;
- Communications (ubiquitous communication and interaction);
- The environment.

A scenario related to each theme and introducing possible innovations was presented during the focus-groups.

This chapter focuses on participants' reactions to the four scenarios.

3.1 Homes and living

First impressions/ general feelings towards the scenario

When exposed to this scenario, participants were largely divided. A majority had negative perceptions and criticisms (especially the oldest).

- A number of innovations - the Personal Robot Assistant, in particular - seem to have irritated and displeased participants while innovations deemed to be more positive were not so often spontaneously cited.

On a positive note, participants initially brought up **the practical aspect of the proposed innovations**: being able to save time and spend it on things that are more interesting or fulfilling than cleaning or domestic chores, in particular.

These judgments were nonetheless largely offset by participants' strong negative feelings about innovations that they felt could:

- **pose a potential danger**: piracy risks, impossibility of ensuring 100% reliability,
- **create a sense of dispossession and intrusion**: a robot or a foreign object is an intrusion in our home and even takes decisions for us,
- **encourage dependence and laziness**: by relying too much on robots, we would wallow in idleness, losing sight of what makes us human,
- **reinforce dependence** on technologies.

These reservations seem particularly strong in all groups and they focus on the robot itself.

The following scenario spontaneously largely arouses **rejection**: a daily life that seems cold, impersonal, with technology playing an excessive role.

- However, within each group, a minority of participants - often having a greater interest in science or technology - indicated their genuine interest in innovations they believe have a clear practical value and whose dangers seem less significant.

"Handy, and lazy at the same time, useful, and dangerous." (France, group 1)

"If it becomes widespread, it will become a society without a soul." (France, group 3)

"Extreme dependence, automation and computerisation of everyday life pushed to the limit. It actually seems realistic to me even if I'm not happy about it." (France, group 5)

Assessment of the scenario

After reconsidering the scenario, the most negative participants were often more open, recognising the value of some innovations even though their perceptions remained fairly negative for the most part.

Overall, all the participants thought the scenario was realistic and expressed little surprise about the innovations considered on an individual basis. However, the overall picture seemed excessive and threatening to them because of the overwhelming role of technologies and their intrusion in every area of everyday life.

Such a scenario therefore seems plausible to them for 2030, as they consider the main obstacles to be psychological or societal rather than technical, since they believe the innovations mostly exist already.

Accordingly, most participants felt that **this scenario would easily be accepted** by a majority of the population:

- Some therefore highlighted that their reactions to the innovations in the scenario were probably the same as those of previous generations to washing machines or dishwashers when they first appeared, but that this did not prevent them from being embraced rapidly.
    - As such, the practical nature of the proposed innovations (simplifying day to day life, saving time, freedom from menial household tasks) was praised by participants across the spectrum.
- Even the most reluctant participants, who rejected these innovations for themselves, **stressed the benefits they might provide to elderly or dependent people**. Robots would provide both necessary assistance and company, thereby enabling them to stay at home rather than being placed in nursing homes.

However, participants felt that there are a number of barriers which prevent this scenario from becoming a reality.

- In this respect, some participants stressed that an increasing number of people are rejecting this pervasiveness of technology, giving up smartphones or trying to go "off-grid". In their opinion, some aspects of the scenario would encourage this trend.

More broadly, this scenario **generated strong reservations** among many of the participants:

- The main obstacle to acceptance of this scenario is that the proposed items (the robot and the intelligent refrigerator, mainly) seem **to make decisions that individuals would ordinarily make themselves**, thus depriving them of free will.
    - Although those most open to these technologies emphasised that everyone is free to configure these machines as they see fit (and therefore to determine their degree of autonomy), most of the participants were still put off by the idea of leaving decision-making to the robots.
    - The fear of losing control of one's environment and daily life was widely mentioned.

- The feeling that **every move would be watched, examined and measured** was also considered to be extremely disturbing.
    - Some wondered about the commercial use that might be made of the data collected by robots.

- A number of participants indicated they were **uncomfortable with the idea that machines were becoming involved in every area of their everyday life**: cooking, cleaning, shopping, etc. Some feared that the robots would eventually be allowed to care for children or their education.
    - These participants felt that life also involves constraints and obligations that we should be willing to accept rather than escape.
    - In a sense, the question of the role of individuals and mankind arises in a more or less conscious manner: what roles will be left to us if technologies free us from all of these constraints?

- Lastly, robots taking over many tasks raises questions on **the impact on employment**: if machines replace humans in every area, what kind of work will people perform? What will they earn?
    - It must also be noted that many participants felt that only the wealthiest people will be able to have robots like the one presented in the scenario.

"It allows us to do other things, fun activities, because the house is well kept. Managing our day, we can do something else, save time. It leaves time to do what you love, it's no fun doing household chores." (France, group 1)

"It isolates you, for household chores you have cleaners, and if you have a robot there, you become isolated, you no longer see anyone." (France, group 1)

"The loss of privacy aspect, people will have trouble with that, just because you have a robot doesn't mean you won't have a family life, but it's a step towards the dehumanisation of society." (France, group 1)

"We would no longer live a human life, we would miss out on a lot of things." (France, group 1)

"There will be a craze at first, we'll only see the positive side, the time saved, but then, you can see this with phones, we change our minds, we hear that they can be dangerous for your health, isolating ourselves with phones. In the beginning, everyone will be happy, but looking back, we'll realise that they're not that great." (France, group 1)

"Totally scary that all of this information about our lives will be stored without us knowing. I don't see the point of storing everything we do at home. I don't think that we're so busy that we don't know what we're doing." (France, group 3)

"We're already experiencing this kind of progress. Except that one day we'll need to manage things correctly, that could be useful for a section of the population in some circumstances, but not the general public. This progress needs to help people who need it." (France, group 5)
"My mother is in a nursing home, she would rather be at home. If there was a robot like this, she could be at home." (France, group 5)

"We need some constraints, they're educational. Life isn't just about having fun, otherwise, when faced with obstacles, we won't know what to do." (France, group 5)

Assessment of the innovations contained in the scenario

Overall, participants were not surprised by the technologies presented: they thought the scenario primarily involved the widespread adoption or access to items that already exist.

Generally speaking, all of the participants agreed that **home insulation technologies** (automatically darkening windows) **and smart electric meters are truly useful innovations** that provide a genuine benefit.

The **Personal Robot Assistant, however, generated quite mixed reactions** regarding these tasks:

- Its role as a personal assistant (planning, personal messaging, weather, etc.) was generally assessed positively, but ultimately seen as the same job that a Smartphone does.
- Similarly, house cleaning was also considered useful, but doubts were expressed about its effectiveness compared to cleaning by a human.
- Complete recording of household events was praised by some for **security reasons** when away from home.
- However, **the recording of household members' habits was generally deemed unacceptable**: an invasion of privacy, a form of surveillance with the fear that data will be sold.
    - The recording of data on the robot's hard drive rather than a company's servers would be more reassuring.

Overall, **the robot's excessively human character and versatility** seem to explain some of the reservations expressed by participants, who would probably have an easier time accepting a number of robots performing these missions separately and looking like robots.

Lastly, the intelligent refrigerator was widely judged negatively:

- The principle: **an extreme form of reliance on assistance**. Help that feels like a gimmick: most were uncomfortable with the idea of relying on a machine to know what they have in their refrigerator.

- Above all, it is the fact that the smart refrigerator itself can define and order the shopping list that bothers them. In this sense, this technology would be more acceptable if the robot just made suggestions that we could amend or validate.
- The smart refrigerator nevertheless generated some interest among the most tech-savvy participants.

"Me, I'm interested in saving energy, not the rest, tinting the windows, heating, and in terms of electricity, it's a money-saver, and energy savings, it's money saved that can be spent elsewhere." (France, group 1)

Overall ranking of the innovations contained in the scenario

Overall, the ranking of the various innovations by perceived value is the same across the groups:

- Innovations enabling home insulation and energy savings are generally widely praised.
- The personal robot assistant generates rather divided responses depending on its tasks, but an overall reluctance dominates.
- Drones that deliver shopping also arouse divided reactions among the participants: there is some interest although many fear the job losses that they would entail.
- Smart refrigerators tend to be seen as a gimmick of limited value.

Alternative scientific innovations

Generally speaking, the participants did not mention other scientific innovations in this area: the innovations presented already seemed enough and they were rather reluctant to see others develop.

3.2 Health and healthcare

First impressions/ general feelings towards the scenario

Participants' spontaneous reactions to this scenario were fairly divided and ranged between:

- In a positive light, **the impression that healthcare will be better managed in the future**: emphasis will be on preventing and diagnosing diseases well in advance in order to improve their treatment. This was highly reassuring to participants.

- However, **the scenario was spontaneously felt to be troubling** for three main reasons:
    - First, **the role of the supermarkets** - and more broadly the commercial aspect of this scenario – was rejected: a move towards commercialisation that was specifically rejected for healthcare.
    - An emphasis on prevention and screening which some feel to **create anxiety**: they feel it would encourage both paranoia and hypochondria.
    - The more widespread belief that **observing and monitoring everyone's health** would breach individual liberty and put the blame on those who do not adopt proper behaviour.

It should be noted that the younger group of participants (aged 18-34) was more receptive than the two groups of 35-64 year-olds, whose views were largely critical.

Assessment of the scenario

After reconsidering the scenario, participants' judgments were often more positive: a number of innovations were considered useful and attractive. However, the underlying philosophy of the scenario continued to generate strong opposition and reservations.

- Above all, it is the **scenario's commercial aspect** and the fact that supermarkets would analyse purchases, provide advice on the basis of the medical situation, and sell health products themselves, that is considered shocking:
    - For the majority of participants, health is too important and intimate a subject to be entrusted to supermarkets.
    - They also expressed suspicions about advice or information provided by retailers who would have an incentive to sell their products.
- The vast majority of participants felt that supermarkets should not play a role in healthcare: **this shared conviction therefore largely set participants against this scenario**.

- The tracking and monitoring of one's state of health through tests, prevention and screening sparked negative reactions from a number of participants:
    - People would be pressured into adopting virtuous lifestyles and habits by guilt or by impeding individual freedom. Some participants complained of **a form of infantilisation** and felt that people would try to prevent them from enjoying certain pleasures of everyday life.
    - However, some participants saw genuine progress in the management of healthcare by taking preventive measures that are more effective than a purely curative approach.
- This emphasis on prevention would be more acceptable to participants if tests and screening remained truly a matter for individual initiative and incentives to rely on them remained reasonable in order not to encourage hypochondria.

- The second part of the scenario was also generally well accepted. The speed and simplicity of formalities and medical exams was indeed found to be reassuring: easier management of healthcare and a care pathway that appears smooth and efficient, taking greater account of each patient's specific characteristics.

Overall, the scenario seemed quite plausible and realistic to the participants as far as the innovations presented go. However, the highly commercial aspect of the scenario led them to state that this system would be widely rejected by the French.

- However, a certain degree of resignation was observed among the most pessimistic participants, who felt that such a scenario would eventually be imposed - in particular by supermarkets who would highlight individual benefits (increased customisation and benefits granted to those willing to reveal their health information, etc.)

"We tend to lose control of our lives when we listen to everything that people tell us." (France, group 1)

"After you get a test result, the supermarket reports that you may have diabetes, so the supermarket recommends you buy certain foods, in the end, they coerce you into consuming, they encourage you to buy things, and they can access your information." (France, group 1)

"It gives me the impression that they want to control people, little by little: 'you have to eat this, eat that, sleep x amount of hours' I feel like saying: 'Leave us alone'." (France, group 1)

"We're chipped like dogs but who is the master?" (France, group 3)

"If I feel like drinking booze tomorrow, who cares? It's a choice. I don't want people to criticise me for it or tell me that it's not good for me." (France, group 3)

Assessment of the innovations contained in the scenario

Participants generally were not that surprised by the innovations, except for the biochips or patches, which many did not know existed.

- Accordingly, **biochips** that monitor one's state of health prompted mostly positive responses:
  - They represent a simple and reassuring way to ensure proper monitoring of one's state of health, in a way that is autonomous for patients: a benefit that seems obvious, especially for medical examinations which would be greatly simplified.
  - However, some expressed a reluctance to have a foreign object inserted into their bodies to monitor them.

- Therapy using stem cells was largely seen as positive: **an innovation that they believed was extremely promising** and which even aroused genuine enthusiasm among some participants, provided that the therapy was truly accessible to all.
  - A few fears were expressed regarding cloning-related abuses.

- **Genetic tests aroused mixed reactions, according to profiles**:
  - Some participants approved of an upstream disease prevention approach that allows them to make informed decisions and adapt their behaviour accordingly.
  - In contrast, other participants, for whom health is primarily a source of anxiety, preferred to steer clear of these potential risks and not to know which diseases they are likely to suffer.
- However, all agreed that if would be preferable for these tests to only be available on prescription, both to avoid the inevitable commercial incentives associated with self-service retail environments and to ensure proper support from a healthcare professional.

- In general, **the medical health record** was well accepted, especially as - for some participants - it appears to be very close to the system provided by the 'Vitale' health card.
  - Personal benefits were viewed as positive: better handling of patients and optimised monitoring of their medical history.
  - However, there was a need for reassurance on confidentiality and anonymity of data. They believed that hacking would always be a risk.

- Participants considered **remote medical consultation by video conferencing** useful in some cases by participants, who nevertheless felt that this should not become the rule and highlighted the need for direct contact with practitioners.
  - However for people living far from a healthcare facility, or in an emergency where rapid contact with a doctor is necessary, this solution was considered to be highly desirable.

- **Personalised dietary advice** aroused some interest among the younger participants. However, there were strong reservations about this advice being offered by supermarkets.

"A nutritional profile, it's great to be able to send it to the doctor, but it shouldn't be the supermarket that tells us that we eat too much. Tests seem useful to me, but what bothers me is if the supermarket tells me what to eat on the basis of my profile." (France, group 1)

"They're going to tell us what we have to eat. You need this butter, this brand - and boom! - they order it for you." (France, group 5)

"Anytime something isn't regulated, it's dangerous. I'm afraid of interpretations. This would stress me out. I would stop shopping." (France, group 6)

Overall ranking of the innovations contained in the scenario

Overall, participants showed great interest in biochips or patches that provide easy management of their health.

They also praised genetic tests and remote consultations for certain situations, but felt this should not undermine the need for genuine support and monitoring by a health professional.

The medical health record also generated interest but reassurance was needed about how researchers would use their data.

Alternative scientific innovations

The participants spontaneously mentioned possible developments relating to transplants or reconstruction of body parts for amputees using 3D printers or exoskeletons, or the development of tools enabling the blind to regain their sight, for example.

3.3 Ubiquitous communication and interaction

First impressions/ general feelings towards the scenario

The participants' spontaneous reactions to this scenario across each group were highly negative. In fact, the people that were interviewed felt it was:

- Both **highly realistic and close to the current situation**: a scenario that would be the logical development of phenomena that are already here.

- And **extremely frightening** at the same time: an expansion of what we now observe, which would lead our society towards a dictatorship - or even a totalitarian state - marked by widespread surveillance and potential mass manipulation.
    - For some, the humans presented in this scenario have become just like robots.

Anxiety and fear, along with **resignation** to this highly likely future, thus dominated the spontaneous reactions.

"It's scary. A bit totalitarian. We feel watched. It's utopian and realistic at the same time. It's a threat to freedom. It's Minority Report, that's totally it! It's scary and oppressive. The day it happens we won't go into stores anymore. And it's not so different from our world today." (France, group 2)

"Scary. Loss of freedom. Refusal. Mindlessness. The logical extension of what is happening now. Manipulation. Big Brother. 1984. Alienation. The end of privacy. A bit like a cult." (France, group 6)

Assessment of the scenario

However, after reconsidering the scenario, judgments were often more moderate: positive points were noted even though the scenario's general picture was still considered disturbing.

- French participants seemed to be **highly critical of the widespread surveillance and climate of suspicion** that it would bring.
    - In the scenario presented, they were under the impression that freedom has almost been eliminated and that technologies instead serve:
        - punishment and control by the state,
        - consumption: by knowing each individual's habits, companies can encourage them to consume more by offering products that match their desires.

- Thus, as for the previous scenario, **the use of personal data by commercial companies** (such as purchase histories, facial recognition) **is largely rejected**.
    - Although participants believed that traders are already doing this right now, it was the increasing adoption of this practice on a large scale that they find frightening and distasteful.
    - Participants lamented the loss of anonymity - particularly the older ones who also felt that the younger generations will give this up more easily.

However, participants were ambivalent about some initially rejected aspects of the scenario.

- Participants sometimes approved of the use of surveillance and monitoring tools **when they saw personal benefits in them**:
  - **For security** to enable law enforcement officials to combat crime more effectively.
    - However, several participants highlighted the risk of abuse, citing the "Minority Report" film.
  - To manage **road traffic**.
  - **For insurance**: the idea that insurance companies could identify and reward good drivers was considered by some to be a good thing.

Participants expressed **a pressing need for reassurance and safeguards on the use of personal data and surveillance**:

- The desire for **strict regulation** to protect individual rights and freedoms: some mentioned strengthening the powers of institutions such as the CNIL.
- The need for individuals always to be able to decide what they want to disclose, thereby regaining some of the freedom that they feel is largely missing from the scenario.

Participants nevertheless expressed resignation about the future evolution of society, noting that usually personal data is disclosed and (partial, at least) privacy rights renounced voluntarily:

- Because brands and companies offer something in exchange (such as benefits for customers who share their data with them),
- Because it represents a broader trend in society, reflected by phenomena such as social networking, reality TV, etc.

For this reason, most of the participants seemed resigned to the inevitability of these developments.

- For many, resistance would have to be at an individual level: by choosing to disconnect oneself, freeing oneself from this "constantly connected" society at the risk of being marginalised.

"Everyone is constantly connected to the internet, you get the impression that there's no 'off' button, you can't stop existing, or say 'I'm not here any more, stop!'. We want to disconnect but it's always there…" (France, group 4)

"I use Skype with people who live far away, it's a natural development. What shocks me is being monitored by authorities and companies, it's total dictatorship. It's like being in a disaster movie" (France, group 2)

"Some people may get away from these hyper-connected locations. There may be an 'online versus defiant' split." (France, group 6)

"What I see every time is a questioning of our free will... Everything is predetermined, our way of thinking, we're being manipulated. There is something positive here, for example, if you get promotional coupons for stores without having to walk through the entire shopping centre." (France, group 6)

"Yes, as long as we have rights it's ok, but that presumes that as consumers we are informed of our rights, and often a lot of things escape us and are picked up by the lobbies." (France, group 4)

"It's not technically impossible, but we're in France and this will never fly. Everything is feasible, but not realistic. We'd be constantly monitored, there's just no way. We're stupid, but not that stupid!" (France, group 2)

Assessment of the innovations contained in the scenario

In general participants said they were not surprised by the innovations, which they believed already exist or are minor improvements to existing innovations.

- The innovations presented in the final paragraph of the scenario were generally very well received and found to be both useful and acceptable.
    - Holographic calls are therefore perceived as being a 3D extension of the features offered by the internet today (Skype, etc.): it is a continuation, which they say will not revolutionise the way we communicate, but it will provide a small benefit that is appreciated.
    - Similarly, holding virtual meetings as part of one's work or distance learning was also considered useful and a source of energy savings as travel will be avoided.
- Participants felt that this was a natural extension of current technologies and did not pose a threat to privacy or freedom.

- In contrast, the continuous monitoring of machines and people using satellites, sensors and cameras was considered **predominantly negative**.
    - However, these technologies were useful in some cases: fighting crime, monitoring the sick (e.g. identifying and rapidly dealing with heart attacks or finding people with Alzheimer's disease).
    - These tools have thus become acceptable, but only under certain conditions. The fact that people can be monitored continuously, without being able to opt out, is a source of great concern: what safeguards and limits should we implement?

- **Facial recognition**, which sparked some rejection initially, appeared beneficial to some, though:
    - For younger participants, it would be a way for some businesses to provide personalised services.
    - For some, it could be useful for security purposes.

- **The collection of data on personal preferences** by commercial businesses was rejected on principle. The example of a store providing ideas for gifts for friends via social networks was widely criticised and ridiculed as a sign of dehumanisation or an unnecessary gimmick.

"I'm not at all excited about holograms: everyone ends up at home, innovation brings everything to your home, we no longer need to go out. I work from home, I see my family from remotely, from home, without going out. I think it's a shame, we're not sharing. Or rather, we are, but with many people in an individual manner." (France, group 4)

"It's frightening... Every waking moment someone's going to offer you something based on what you like, what you do." (France, group 6)

"Prevention comes to mind, if we could have fewer accidents... it could be useful." (France, group 6)

Overall ranking of the innovations contained in the scenario

We therefore broadly observe a genuine attraction for virtual reality technologies, which can provide genuine benefits.

However, reactions to the continuous monitoring of machines and people and the use of facial recognition technologies were more mixed: an objection in principle but recognised as being useful in a number of cases.

Nevertheless, the collection of personal preference data by commercial businesses is broadly rejected.

Alternative scientific innovations

The participants cited few other innovations in the field of communications, but they called for greater security and confidentiality on the internet in order to ensure better protection of their privacy.

To a lesser extent, Google Glass and contactless cards which enable us to perform certain tasks (electronic wallets, travel passes, etc.) were also mentioned.

3.4 Environment

First impressions/ general feelings towards the scenario

The participants spontaneously **reacted positively** to this scenario: **it represents a future that seems desirable**. They highlighted energy savings, stopping waste and better consideration of the environment than is the case today.

At the same time, many felt that this scenario was utopian because it requires both a genuine willingness on the part of political and economic leaders to move in this direction and, more broadly, global awareness and education of citizens in order to match these innovations with changes in behaviour.

It should be noted, though, as is the case with other scenarios, that there is a perception of a rather sanitised and uniform world in which some (especially the younger participants) would prefer not to project themselves.

"Ideal. A world of peace, no negative aspect. Utopia. Not that utopian though, but energy efficiency is not impossible, we will need closed water systems... It's really desirable. I'm sceptical. It's a bit sad, everything will be like Marne-la-Vallée, a very clean and beautiful town that is too smooth. It would be sterile." (France, group 2)

"Utopian and plausible at the same time. Ideal above all. Idyllic. It's the opposite of what we currently live in, ideal as it would be a wonderful representation of a society in harmony with nature. Respect for the planet." (France, group 4)

"It's great. Very good. Ecological. Viable. Renewable energy. True progress. I don't see anything negative. It shows genuine awareness." (France, group 5)

Assessment of the scenario

After reconsidering the scenario, participants' **perceptions were more or less unchanged**, although some of them raised concerns about geo-engineering techniques that would be used to control global warming and new farm management practices.

- The scenario was generally considered to be **highly desirable**, along with the belief that it is plausible.
  - The example of the green neighbourhoods being created in an increasing number of cities was mentioned several times, echoing the homes described at the beginning of the scenario.

- For this reason, the participants felt that **this scenario would be very acceptable** in principle to the public.
  - Even though a few people expressed concern that individual behaviours would be monitored or tracked to comply with environmental constraints.

- Participants therefore tended to question not the acceptability of this "utopian" scenario, but **the likelihood that it could be implemented** within 15 years.

- A scenario that would require profound changes in public attitudes: environmental awareness, giving up certain comforts as well as some forms of individualistic behaviour.
- The need for genuine political will to drive these changes. The participants were sceptical about this.
- The financial costs involved in setting up a double water management system or home insulation (especially in older homes). Again, participants felt that only the wealthy would be able to benefit from these innovations.

"It would need to be being tested today for this to work in 15 years. But before we even start setting all of this up, we need to change our behaviour. We're starting to recycle but it's not part of our culture." (France, group 2)

"People will dictate to us what we have to do. We'll be monitored, but at the same time, it could work. I feel like I'm going to have to submit accounts... No showering for more than 3 minutes!" (France, group 2)

"This text is very technical, it doesn't mention anything about values: sharing, trading, crafts, the words we'd like to hear because we're afraid of where we're going. There are no emotions." (France, group 5)

"We won't have any choice. I think the idea is to make money, the crisis has led to trying to find ways to reduce costs: we pay attention to photocopies, etc. I don't see how we're going to achieve this tomorrow, our government isn't pushing for it. No one is for this." (France, group 4)

"It's going to be very hard to implement. But it's a question of will." (France, group 5)

"I think the first part can easily be achieved: recycling water and building materials." (France, group 5)

Assessment of the innovations contained in the scenario

Participants saw **the innovations in the first paragraph on housing in a very positive light**: energy efficient buildings, use of recycled materials, clean energy produced by each home, double water management system.

- All of these innovations are seen as extremely useful. Although they were not considered to be surprising – since they were already familiar - many of the participants questioned the ability to generalise these innovations in housing within just 15 years and they highlighted the costs that this would entail for older dwellings.
- To a lesser extent, there was criticism of wind turbines (deemed to be noisy) and solar panels (whose construction requires rare materials and whose energy efficiency is questioned, as is their recycling).

"They presented it to us like it was a technological advance. Renewable energies, they tell us that it's progress, but what are we going to do with panels that cannot be recycled? As with all new technologies, there is both positive and negative. People emphasise energy savings, but no one tells us that the panels are not recyclable." (France, group 5)

The recycling of waste was not questioned in principle: more than technical barriers, participants wondered about individual behaviour: will all French citizens and industrial players really be willing to adopt proper sorting habits?

Participants were fairly divided on **agricultural practices**, and rather surprised by the technologies presented (especially the use of satellites and sensors to monitor a farm accurately).

- The positively received aspects included food safety checks and the attempt to rationalise the use of resources and fertilizers.
- Nevertheless, for some participants, **the agricultural practices presented seemed to be firmly rooted in intensive agriculture** that relies on large industrial farms. These participants it would in the future prefer to promote more sustainable agriculture, with smaller farms, which would probably not be able to afford the use of satellites and sensors in their work.
- In this regard, several of the participants felt that the future of agriculture and food would rely less on scientific and technological innovations than on new behaviours: favouring local products, eating less meat, etc.

"It's not good, because it encourages mass consumption without questioning the food industry or intensive livestock rearing, that's not what we need to work on. We need to change behaviours such as eating less meat, consumption habits must be changed in order to avoid resorting to this kind of development." (France, group 2)

"The end of traditional agriculture. The end of a trade, so to speak, if all agriculture is monitored by satellites. This is in line with the standardisation of farming, and know-how." (France, group 5)

Lastly, **geo-engineering techniques were met with scepticism, and even genuine concern**.

- The very idea of them and the techniques presented were often misunderstood or confusing: they are initiatives that remain very distant for many participants, who had a hard time imagining what they are.
- Moreover, certain techniques such as ocean fertilisation and carbon sequestration were **considered troubling**:
    - Medium or long-term effects were difficult to predict (like the burial of nuclear waste).
    - The impression that mankind is continuing to play sorcerer's apprentice while claiming to protect the environment. For some participants, it seemed contradictory to embark on major projects involving irreversible changes in our environment, in the name of protecting the planet.

"We think we're superior to nature but even if we implement these innovations it won't change things." (France, group 2)

"In my opinion, we shouldn't change what exists in nature.
- Yes, but nature has already been changed. We need to restore balance."
(France, group 4)

Overall ranking of the innovations contained in the scenario

Ultimately, the participants praised innovations in housing, insulation and energy production the most: these advances represent better quality of life and respect for the environment.

New agricultural practices generated more mixed responses, as some participants felt that they would not really provide the conditions that are required for a better diet.

Lastly, geo-engineering techniques – which are considered more technical and potentially worrying - were clearly less popular, either because they were poorly understood or because their impact on the environment was deemed too great.

Alternative scientific innovations

Participants did not mention other environmental innovations but rather emphasised the need to change individual and collective behaviours in order to protect the environment. Solutions included: eating less meat, eating less, reducing energy consumption, etc. Many participants feel that these changes are an essential condition for better protection of the environment.

IV. CONCLUSION

In the end, most participants felt that their views had not changed fundamentally during the discussion.

- A minority of participants, who showed genuine interest or curiosity about innovation in general, expressed their expectations and even some impatience about trying out the innovations presented in the scenarios. Aware of the risks and scope for abuse posed by these technologies, they were nevertheless optimistic, feeling that it is up to each of us to make the best use of the possibilities afforded by science and technology, and that it is futile to resist it.

- A majority of participants, who were more cautious about innovation in general, nevertheless often expressed an interest in the objects or advances presented, even though they had initially thought of them as useless or dangerous. However, these participants were concerned (and resigned) about the social changes wrought by technology and above all they expressed fear that machines will be less and less at the service of mankind; indeed, mankind will increasingly be controlled by technology and will lose control over its environment. Some of the participants therefore expressed a wish to "take a step back" and to learn how to use these innovations sparingly.