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Ethics Dialogues

Experiencing Ethics through 'things': Open IoT, Civil Drones and Wearable Sensors

Philip Boucher
Susana Nascimento
Lucia Vesnić-Alujević
Ângela Guimarães Pereira

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Joint Research Centre
Institute for the Protection and Security of the Citizen

Contact information

Ângela Guimarães Pereira
Address: Joint Research Centre, Via Enrico Fermi 2749, TP 361, 21027 Ispra (VA), Italy E-mail:
angela.pereira@jrc.ec.europa.eu
Tel.: +39 0332 785340

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Abstract

This report responds with a methodological proposal to the quest for "Responsible Research and Innovation" which is presented as the European Commission's Horizon 2020 lemma. RRI is supported by five main pillars that mirror different commitments that are deemed to support responsibility in research and innovation: participation, ethics, equity, openness and education. Governance of research and innovation lies with those pillars and commitments. This report uses three case studies to propose a methodology that combines public engagement with ethics evaluations. We have called it "ethics dialogues" about science and technology. This concept implements a methodological approach that has been developing for the last years at the JRC, which attempts to make ethics a dialogical process, given the societal transformation that information technologies are co-producing. Through different social research approaches, the proposed methodology was used in three cases: IoT, Civil Drones and Wearable Sensors, investigating different ethical questions.

'Ethics Dialogues'¹

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¹ The opinions expressed in this report are sole of the authors and cannot be attributed to the European Commission in any circumstance.

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Summary

This report responds to the partial requirements of the deliverable 3 of the Joint Research Centre's institutional project E-CIT, responding to DG RTD quest of implementing the Horizon 2020 lemma: Responsible Research and Innovation (RRI). The present report represents also the development of an in-house capacity of RRI.

The work presented here aims at, amongst others, testing a methodology that combines two of the pillars that sustain RRI: public engagement and ethics evaluations. We have called it "ethics dialogues" about science and technology.

The concept implements a methodological approach that we have been developing at the JRC for the past three years with the overarching idea of making ethics about techno-science a dialogical process in a world of profound transformative momentum.

The proposed methodology is being tested through three cases: Drones, Wearable Sensors and an overarching on-going movement of "do it yourself" (DIY) and Open IoT which is very relevant for reflections about innovation and creativity in Europe.

We have implemented "ethics dialogues" with classic social research methodologies to address, experience and deliberate ethical questions in each of the three cases, namely through in-depth interviews and focus groups in 3 different Member States.

We conclude that, whilst these dialogues might not be representative of the collective deliberations about ethics of emerging technologies, they are certainly a valuable instrument to unveil what ethics issues and dilemmas are there, that need attention and further scrutiny. We also contend that public engagement in ethics about science and technology is essentially inevitable given the societal transformation that information technologies are co-producing. In other words, if citizens are not invited to participate in these kinds of discussions, they will engage with the discussions in DIY ways. In a world where specific interests create new *normativities*, transforming our received notions of humanness and co-producing new epistemologies and ontologies, a collective deliberation about narratives, values and norms by which we want to live - *ethics dialogues* - is otherwise imperative.

Preamble

“Responsible Research and Innovation (RRI) is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)”¹

In the Horizon 2020, RRI is a “cross-cutting” action. A key pillar of RRI is citizen engagement in the processes of research and innovation. This report responds with a methodological proposal to the quest for “Responsible Research and Innovation” which is presented as the European Commission’s Horizon 2020 lemma. RRI is supported by five main pillars, which mirror different commitments that sustain *responsibility* in research and innovation: participation, ethics, equity, openness and education. Governance of research and innovation lies with those pillars and commitments.

In the Horizon 2020, RRI is a “cross-cutting” action. A key pillar of RRI is citizen engagement in the processes of research and innovation. Given that one of the objectives of engagement should be alignment of social values, societal concerns, grand-challenges to the research and innovation proposals, we need to diagnose now what challenges and what needs lie ahead with the current practice of societal engagement in the debates of science and technology, so that different forms of “encouragement” can be sought within the RRI perspective. Public engagement has been justified in so many ways of normative and prescriptive nature, being embedded in many public policies as mandatory, e.g. in environmental planning, industrial risk assessments and the like. But that has not been the case for science and technology development. What we have most of the times is what we can call “experiments” that are often framed in the so called “public understanding of science” syndrome - rather than a perspective; i.e. the suggestion that the *publics* have a deficit of knowledge that needs to be cured. What the RRI framework suggests (and we concur) is that engaging the *publics* in research and policy is an ethical issue. It is a matter of responsibility and trust, as well as a matter of solidarity: it is through collective enterprise that we will live the lives we wish to live on the basis of values and norms that we collectively decide upon. Hence, citizen engagement in science and technology (as opposed to consumer engagement), is not just needed, it is an urgent matter that the call for innovation and creative endeavours need to make genuine room for.

This report uses three case studies to propose a methodology that combines public engagement with ethics discussions. We have called it “ethics dialogues” about science and technology. This concept implements a methodological approach that has been developing for the last years at the JRC, which attempts to make ethics a dialogical process, given the societal transformation that information technologies are co-producing. Through different social research approaches, the proposed methodology was used in three cases: Open Internet of Things, Civil Drones and Wearable Sensors, investigating different ethical questions.

¹ Von Schomberg, R. (2011) ‘Prospects for Technology Assessment in a framework of responsible research and innovation’ in: *Technikfolgen abschätzen lehren: Bildungspotenziale transdisziplinärer Methode*, P.39-61, Wiesbaden: Springer VS

1. Background

1.1 On Public Engagement²

The UK BSE³ “scandal” of the mid 1980s to mid-1990s is often cited as pivotal in the change of direction in the relations between science and policy making. A key moment was the publication of the 2000 House of Lords report on *Science and Society* followed a year later by the European Commission’s *Science and Society Action Plan* (European Commission 2002), as well as the EU 5th Framework research programme’s “Raising Awareness of Science and Technology” activity of the late 1990s. Partly as a result of PUS failings, public perception of science worsened throughout the 1990s, and a new language of “science & society” towards dialogue engagement emerged. This phase corresponds to Callon’s (2001) model of science and public relations as a “public dialogue and participation model”.

Fast forward, the science community is (supposedly) embracing dialogue and engagement [recognising that many controversies had made it a non-negotiable clause of their “license to operate”]. A new term entered the lexicon of public engagement during the 2000s: there had been a surge of interest in moving engagement “upstream” [e.g. The Royal Society’s nanotechnology report in 2004⁴: *constructive and proactive debate about the future of nanotechnologies to be undertaken now...*]; it focuses on establishing a two-way dialogue between citizens and other actors on science and technology (S&T) challenges facing society.

This phase corresponds to what Callon (2001) described as the model “public co-production of knowledge”, as far as science and public relations are concerned.

After over four decades from its publication, Arnstein’s seminal article (1969) remains an inspiration and a warning for promoters of public participation in various areas of research and policy (De Marchi *Op. cit.*). Her ladder clearly distinguishes the “public participation” actions that treat groups and minorities as objects of socio-political exercises from those that create the spaces and the conditions for them to become responsible and aware subjects in deliberations concerning their health, well-being, and preferred ways of life (De Marchi *Idem*). Reported and discussed initiatives within the public participation practice are countless – see for example, Curvelo 2013. From agriculture, fisheries, forestry, mining, energy, environmental protection, climate change, environmental health, and sustainability, there are a myriad of experience with public “engagements”.

Box 1.1. Public participation

“The expression “public participation” can be understood in different ways, also according to the context in which it is used. As an umbrella expression, it can be taken to mean any kind of involvement of the citizens in the *res publica*. It includes both, individual and collective, organized action and forms as different as voting, party and/or association membership, political activism, and public protest. However, as it is nowadays most commonly used, “public participation” refers to forms of engagement other than the ones characterizing liberal democracies. It directs attention to the “civil society” and, in particular, to tensions originating in it also as a result of dissatisfaction with the political system and its consolidated forms of public representation. This has been traditionally the territory of students of collective behaviour and social movements in particular, but customary conceptual categories have become obsolete also due to the new possibilities of action and interaction made extensively and rapidly available by the ICT (information and communication technology).” De Marchi 2013.

² Public participation can be defined as “the practice of involving members of the public in the agenda-setting, decision-making, and policy-forming activities of organizations/institutions responsible for policy development” (Rowe & Frewer 2005, p. 253). Elsewhere, we have reviewed public engagement from various perspectives, see Guimarães Pereira 2013.

³ Bovine spongiform encephalopathy commonly designated as “mad cow disease”.

⁴ The Royal Society and The Royal Academy of Engineering 2004: Nanoscience and nanotechnologies: opportunities and uncertainties, July

As Douglas (2005) pointed out ‘*values are needed to inform scientific and technical analysis*’ as the most intense and stormy controversies over science and technology are mostly related with ‘*moral uncertainties*’ - *the lack of commonly shared normative yardsticks to underpin collective decision-making* - than with the uncertainties about the impacts and risks those developments may raise (Hansen, 2010). Jasanoff (2011a, 2001b) suggested that the ‘(bio)constitutional moment’ we are living, where “*revolutions in our understanding of what life is burrow so deep into the foundations of our social and political structures that they necessitate, in effect, a rethinking of law at a constitutional level*”. Likewise, we live a cyber-constitutional moment, as we progressively become hybrids of biological and informational nature⁵.

1.2 On Ethics

Ethics as applied to science and technology policy needs constant *veillance*. Whilst the application of ethics in science and technology realms has largely been in the hands of professional communities, the failures of the scientific community’s *ethos* in respecting individuals in research during World War II, and before that the role of statistical science in upholding eugenics (Hacking 1990), gave ethics a definitive part for addressing values challenges arising from techno-science developments. During the 1990s ethics was established as institutional practice⁶ - see box 1.2 - through various forms, with the establishment of ethics committees producing official (though usually non-binding) opinions on ethical, legal, and social aspects; the creation of expert ethics committees, of ethics as expert knowledge, and of mandatory ethical checklists to comply with (Tallacchini 2009). Whilst ethics inherently bounds regulatory frameworks including science and technology innovation policies, the pace at which techno-science is developing is making it untreatable with the current institutional arrangements.

Box 1.2 The EGE

At the level of European Commission, the European Group of Ethics¹ is described as “an independent, pluralist and multidisciplinary body advising the European Commission on ethics in science and new technologies in connection with Community legislation or policies”.

“The EGE members are chosen by the president of the Commission asked to offer independent advice to the Commission. They are “appointed on the basis of their expertise and a geographical distribution that reflects the diversity in the European Union.”

Moreover, in certain domains of science and technology research has been further fragmented, including along private and public dimensions arising from privatisation of the scientific enterprise, collaborative and competitive enterprises, developing within institutional and informal spaces [the “garage” and “do it yourself” movements; the “Open everything” paradigm] giving rise to different ethics “strategies”. With an enlarged set of actors participating in the techno-scientific knowledge production with their norms and values, not only the loci of ethics have been distributed and extended (Toulmin in Lifson 1997; Tallacchini 2015) but also systematically interrogated, including by citizens, as well as by old and new media. The digital culture has accelerated this process by providing it with both ever-larger social actors and ever more empowering tools. Such social actors appear before us with new roles and also new responsibilities - for example, in the field of environmental health, and other policy relevant scientific arenas.

⁵ See Curvelo *et al.* 2013.

⁶ “The creation of an advisory group on European ethics was originally prompted by the regulatory challenges faced by the European Community in the wake of the rapid advances in biotechnology and genetic engineering in the late 1980s and early 1990s. The need for an institutional mechanism to facilitate debate and address public concern on the ethical issues raised by the application of the new biotechnologies was perceived by the Commission as essential to the adoption of an EU regulatory framework to promote economic investment and competitiveness” (Plomer 2008).

But ethics has not been dialogical by definition. In a world where growing complexity, hybridisation of ways of knowing and co-existence of different knowledge production systems, values and norms and where specific elites deeply transform and normalise in the name of private considerations and interests, our lives, it seems reasonable that the work on responsible research and innovation is centred on dialogues about ethics. As Davies (2013) pointed out, our thinking about public participation should not be too focused on reasoned argument, “running the risk of ignoring other important aspects of how we relate to science and technology” (*Op. cit.*).

It is in this context of understanding public engagement in science and technology that we have carried out the work presented in this report.

1.3 Ethics Dialogues⁷

Conversations about ethics of science and technology with citizenry are certainly not a new endeavour, (see for example Box 3.1 describing a project by Davies *et al.* 2009; but also Bombard *et al.* 2011).

Our proposal, on the one hand suggests that within the context of RRI, ethics (evaluations) cannot be handed to experts alone. Hence, we argue that such *evaluations* need to be carried out through dialogical processes of public engagement. Therefore, our proposal is that the “responsible” in RRI cannot be guaranteed if an extended community is not involved in the discussions of norms, values and other ethical issues by which we wish to live.

Furthermore, we argue that ethics dialogues are not about creating “safe spaces” where discussions of values and norms about research and innovation can be interrogated, problematised and deliberated. It is also about experiencing ethics or understanding the ethics in innovations, e.g. through the design of objects. The ultimate aim of such reflexive experiences is about getting empowered and deciding on what agency we (as individuals or collectively) wish to have about, not only the nature but also the social acceptability of the interactions that these new objects tease out. For example, those who have to study or evaluate ethics need to engage with the makers community and tap into the ethics by which such communities make things.

We have started by using classic social research settings such as focus groups⁸ and in-depth interviews combined with methodologies, such as material deliberation. Materiality here

Box 1.3 Deepening Ethical Engagement and Participation with Emerging Nanotechnologies (DEEPEN Project) - This three year research project (2006-2009) was funded by the European Commission’s Framework Programme 6 and involved researchers from ethics, philosophy and the social and political sciences from four European institutions: the Institute for Hazard and Risk Research at Durham University (UK), the Darmstadt University of Technology (Germany), the Centre for Social Studies at the University of Coimbra (Portugal), and the University of Twente (Netherlands). The overall aim of the project was ‘*To deepen ethical understanding of issues related to emerging nanotechnologies through an interdisciplinary approach utilising insights from philosophy, ethics, and the social sciences*’ (Davies *et al.* 2009). The project focused specifically on two areas of nanotechnology development: ‘*the development of nano-sensors, and their potential to become integrated within electronic consumer goods, cars, medical devices, security and surveillance systems, pollution monitoring devices and so on; and the field of nano-biotechnology, and its promise of investigating the machinery of life*’ (Johnson, N.d.). One of the activities contemplated in the project approach was the organization of a number of new deliberative processes aimed at deepening the understanding of ethical issues in nanotechnology and across a diverse range of public and political contexts. The project has found that ‘*current efforts in ‘responsible development’—whether in ethical analysis, public engagement, or new forms of governance—while impressive, are still dominated by limited and limiting modes of thought. They will require reconfiguration in order to fulfil the promise of socially responsible nanotechnology*’ (Davies *et al.* 2009, p. 3).

⁷ *Ethics dialogues* appears as an expression in school environments (Ray 1996), and as a call for keeping a debate on ethics of information technology (Hacker *et al.* 2007), but not as ‘methodology’.

should be understood as not only the objects of our enquiry (in this case drones or wearable sensors or the things in IoT), but also policy papers, newspapers, online materials to which we all are exposed.

As we stated elsewhere, the central question we want to ask is “by what ethics we want to live?” where everybody is concerned. Unlike other technological developments in the past ICT are not *experimentable* in a Lab. We are all the experiment whether engaging with the digital culture or not. “Ethics dialogues” is also about capacity building to the extent that those engaged in the projects get aware that by design certain values and norms get ‘printed’ or moulded on the material or function of the gadgets we use everyday.

Finally, we actually critically oppose those who see dialogues about ethics not being informative of policy making. Again, as Douglas (2005) argued moral uncertainties can be much more powerful than risk related ones, when it comes to technology uptake.

The journey that we are about to tell, could have been imagined in different ways; choosing classic social research settings can help practitioners to feel *safe* about engaging on dialogues about ethics with an extended peer community. On the other hand, we see that the context in which these encounters may occur can be provide insightful, experiential, or deliberative, outcomes (or all together) depending on the request they are set with.

This work was not implemented in isolation, but as part of a larger project called *Empowering Citizens’ Rights in Emerging ICT* (E-CIT). E-CIT was designed to explore how ethics assessment can be combined with public engagement approaches to develop a method for exploring ethics of emerging ICT with citizens in an approach that is dialogic in its structure.

⁸ Focus groups are a qualitative research method. They can be referred to as a sort of group interviewing, however more important is the interaction between group members themselves and in that sense it is much more than an interview. Powell *et al.* (1996) define it as “a group of individuals selected and assembled by researchers to discuss and comment on, from personal experience, the topic that is the subject of the research. (p. 499). Some of the most important characteristics are: “organised discussion” and “interaction” (Kitzinger 1994), “collective activity” (Powell *et al.* 1996), “social events” (Goss & Leinbach 1996). The focus groups are looking into participants opinions, attitudes, beliefs, feelings and experiences about the topic that is discussed, which are more easily revealed through the interaction with others than using other type of qualitative research methods. The context of a group is important because it produces specific reactions and multiplicity of views and larger amount of information produced in less time.

ETHICS DIALOGUES CASES

2 Open (Internet of) Things

2.1 On Internet of Things and DIY/Maker Trends

Among its many possible definitions, the Internet of Things (IoT) can be described as a global network infrastructure that links physical and virtual objects through data capture, communication and cloud computing capabilities. The main idea is that ‘things’ (e.g. objects, environments, vehicles, even humans) are increasingly connected to each other and to other systems through the Internet, with the ability to sense, communicate, store, retrieve and produce new information⁹. IoT has been a subject of intense policy discussion and ethical debate within Europe in research programmes, expert groups and studies. For instance, since its launch in 2009, the European Research Cluster on IoT¹⁰ has greatly contributed to setting up a policy framework and connecting key stakeholders in the field. More specifically to the scope of the present report, from 2010 to 2013 the European Commission also established an Expert Group on IoT, which produced a number of outputs and stimulated further debates that clearly recognised the ethical issues rising from the development and deployment of IoT technologies and visions.

As Gerald Santucci recently presented as a keynote speaker at the conference “Internet of Things: Philosophy” (3-5th July 2014), “the full deployment of the IoT is likely to bring about a set of new issues such as: the renegotiation of agency between humans and non-humans in a hyper-connected world; the autonomy of humans in a world where smart connected objects will outnumber humans by a ratio of at least 1 to 10; human dignity and justice; the ‘right to be forgotten’ in a scenario of billions of things exchanging one’s data; trust in the things that will decide on behalf of the humans or for them.”¹¹. Another key contribution to an ethical approach comes from the IoT Council, a think-tank, consultancy, accelerator and forecasting group founded by Rob Kranenburg. From the start, it acknowledges IoT as “a paradigm shift and an ontological change” in terms of “what it means to be human and what it means to be ‘in the world’”, and sets its mission of pushing forward the field by “making the most open, inclusive and innovative Internet of Things.”¹² Also the study conducted by Guimarães Pereira *et al.* (2013) extended the discussion by identifying IoT features, such as pervasiveness, strong mediation, machine-to-machine interaction, big data, etc., that call for ethical analysis based on present day values, rights and norms, particularly focusing on agency, autonomy and social justice.

The present case study builds on these previous ethical analysis with the aim of exploring how citizens can be further empowered in IoT technologies and spaces in relation to their values, expectations and contexts. Enhancing ‘ethical dialogues’ in this field was specifically analysed in emerging Do-It-Yourself (DIY) and maker trends, which are offering new tools and venues for citizens to intervene directly in the actual development and building of IoT. Our focus is on the potential and limitations of such trends in several settings to advance and promote the notions of autonomy, control and diversity for expanded groups of citizens.

We are witnessing a surge of new ‘making’, ‘fabricating’ and ‘manufacturing’ paradigms based on lowering costs and easier access to hardware and software tools, and covering a broad scope of people and communities with miscellaneous goals, from creative self-expression and technical curiosity, through more commercial objectives up to ethical

⁹ For definitions of IoT see e.g. <http://postscapes.com/Internet-of-things-definition>. Accessed 28 November 2014.

¹⁰ <http://www.Internet-of-things-research.eu/>. Accessed 28 November 2014.

¹¹ <http://Internetofthingsphilosophy.com/keynote-speakers/>. Accessed 28 November 2014.

¹² <http://www.theInternetofthings.eu/council-mission>. Accessed 28 November 2014.

commitments and political frameworks. More and more individual and collective actors are coming into play, from crafters, hackers, artists, designers, scientists and engineers, to amateurs, hobbyists, entrepreneurs, companies, students, professors, researchers, children, communities, and civil society organisations. They are modifying and creating things through more open and collaborative processes, in what can be called Do-It-Yourself (DIY), Doing-It-Together (DIT) or Doing-It-With-Others (DIWO) ways. A recent report from Deloitte Center for the Edge gives an overview of this next generation of craftspeople, tinkerers, hobbyists and inventors, who are experimenting with new fabrication tools and forming communities that are reshaping the meaning and ways of doing technological innovation. Quoting the report, “making – the next generation of inventing and do-it-yourself – is creeping into everyday discourse, with the emerging maker movement referenced in connection with topics ranging from the rebirth of manufacturing to job skills development to reconnecting with our roots.” (Deloitte 2014)

The growing importance of such trends is explicitly addressed in the recent report *Digital Futures* by DG CONNECT (2014) in the section on the DIY economy. Through the new realities of self-production, the report previews that “collective ownership, the rise of sharing economy and *prosumerism* signal a watershed shift in personal economic paradigms and values by new generations of economic actors. Non-material values rise as people find the material world is increasingly mutable and transformable with micro-power generation and localised manufacturing (3D printing), cradle-to-cradle recycling and up-cycling, and augmented reality and virtual world digital overlays.” (p.98) The DIY impact on innovation ecosystems from an economic, legal and regulatory perspective goes beyond the scope of the present analysis. Instead, our focus relates to the societal and ethical implications of the DIY and maker trends, which are present in the report’s reference to “non-material” values, lifestyles and behaviours that can enhance participation, sharing and even awareness of sustainability challenges.

Characterised by sharing and openness features, DIY and maker paradigms are generating 'disruptive innovations' that are predicted for instance by the Deloitte report, to greatly affect technologies, organisations, government, education and ultimately society, and as such, makers are leading the vanguard in creating, experimenting, producing and distributing more quickly new and better technological solutions. In fact, these new realities are increasingly a part of IoT design and development. In an event organized by the digital agency TH_NK, concerns were raised about how IoT technologists, brands and manufacturers may be neglecting the ideas of openness. The ‘maker’ mentality is growing to the point that Lea Simpson, Strategy Director for the agency in a recent article in *Wired* writes that “it will take user-generated products and hacked physical connections for brands to make sense of the Internet of things. It will be ugly, soldered-together networked devices (not the gamified toothbrush) that will light the way for them. Beautiful mistakes and unexpected outcomes that will form their strategies.” (Simpson 2014)

The features of sharing and openness are even considered, for some authors such as Jeremy Rifkins, as embedded themselves in the technological IoT framework. In his latest book, Rifkin states that “the IoT is the technological “soul mate” of an emerging Collaborative Commons. (...) The IoT enables billions of people to engage in peer-to-peer social networks and cocreate the many new economic opportunities and practices that constitute life on the emerging Collaborative Commons. The platform turns everyone into a prosumer and every activity into a collaboration. The IoT potentially connects every human being in a global community, allowing social capital to flourish on an unprecedented scale, making a sharing economy possible.” (2014, p. 21). Whether technical features can be readily translated to societal changes has been a matter of intense debate for instance in Science and Technology Studies (STS), and one we won’t engage with directly in the present analysis. Nevertheless, it

is relevant to explore how certain ethical and social issues, such as autonomy, control and diversity that are the focus of our analysis, are being enacted in DIY and Maker trends that are developing more distributed, collaborative and peer-to-peer tools, platforms and spaces.

A clear example of how DIY and Maker trends are more and more a part of IoT is the wide use of open source solutions, of which the most successful is clearly the Arduino¹³, a micro-controller and development environment, which started in 2005 at the Interaction Design Institute Ivrea in Italy. It is considered to be an ideal open hardware platform for experimenting with the world of IoT (Doukas 2012), mostly due to its flexibility, simplicity, easy-to-use framework, and large community of developers and enthusiasts. As Massimo Banzi, one of its founders, acknowledges, Arduino as a platform is enabling a great variety of Maker IoT projects developed by individuals and communities who are coming up with new and unconstrained ideas, and is now also being used by private companies to test new products and stimulate innovation¹⁴.

Also noteworthy from an ethical point of view, in this year's Maker Faire Rome, Banzi (2014c) presented the "Arduino Manifesto of Connected Devices", inspired by the Slow Food movement, with the key values of 'good', 'clean' and 'fair'. Regarding 'good', the argument is that "open source is a way to be good - at least the key technologies are open so we can see what is going on", and at the end to stimulate innovation in the sense of enabling more people to build technologies. As for 'clean', the call is against disposable design and for long-term user experience and sustainability, by ensuring products can easily be given a new life, upgraded or moved over to other cloud service providers. Regarding 'fair', Banzi argued for more control about what happens to users' data, making sure "people are not the product" and for example, can run their own cloud service or use a safe service or wi-fi modules as the one built by Arduino with Atmel.

It is thus noticeable an emerging trend of what can be called 'Open IoT', where a greater number of makers, developers, tinkerers and enthusiasts are taking the opportunities to change or to create their own versions of IoT technologies or products. In a certain way, following Banzi's argument, it is a way to regain some control over most devices offered by manufacturers. The latter usually keep a gatekeeper control over them even when they offer public APIs (Application Programming Interfaces), as Nest has done for its thermostat, in order to foster the development of further integrations and applications from whoever wants to do them. In fact, several companies have begun to follow this semi-open development strategy, up to a point where soon, according to some predictions, "after the first wave of the Internet of Things, open APIs and root access will become a selling point. Either enough customers (especially business customers) will want them badly enough, or smart hardware will become enough of a commodity that *startups* will start selling "repluggable" Smart Things, which buyers can root and configure to speak to the server(s) of their choice." (Evans 2014).

The smart home is an example of the eminent future of self-installed, self-managed, and in some cases also self-built IoT devices. The examples of open source and programmable devices and networks that are available for anyone to download, to use and to control yourself, have been on the rise for the last two years (Finley, 2013, 2014a, 2014b). It shows how the interconnection between DIY and IoT paradigms is unveiling large communities of people from different backgrounds, skills and knowledge, and not only from conventional institutions of academia, research centres, institutes, business or industry, that are able to directly intervene in technological innovation. That is, they are creating things on their own

¹³ <http://www.arduino.cc/>. Accessed 12 December 2014.

¹⁴ For example, Arduino itself has a partnership with Atmel, a leader in microcontroller and touch technology solutions, in which they jointly develop IoT products. See e.g. Banzi 2014a.

or together with others, locally and globally, or as part of local projects or as response to their own everyday needs.

2.2 “Ethics Dialogues” – methodology

The case study on IoT is based on qualitative methods of inquiry including desk-based research, informal contacts, semi-structured interviews and non-participant observation. Throughout the year, desk-based research was conducted on existing Fab Labs, Hackerspaces and Makerspaces, their projects and activities as documented online. Contacts were established and developed with key experts, researchers and professionals on IoT from DIY and maker trends, particularly from Fab Labs, Makerspaces and Hackerspaces as emerging fabrication spaces which display an open and collaborative logic involving diverse actors or stakeholders.

These contacts were not only an essential source of information, but also a valuable entry point to the maker communities. A snowball technique was deemed as more adequate, considering the size of the communities and our privileged contact with key members of the Fab Lab network. The initial pool of contacts referred us to other participants willing to contribute to our research, and thus, 9 interviews were conducted with Fab Lab managers, first in FAB10 Barcelona (2-8 July 2014), the event gathering the international Fab Lab community from more than 250 laboratories in more than 40 countries, and afterwards, through Skype to other Fab Lab managers not present in FAB10 or following initial contact in this event.

Finally, we selected another event from the maker community to events to collect further empirical material from a wide diversity of experts, researchers and projects. Informal contacts with key experts and makers, together with non-participant observation of projects, were conducted in Maker Faire Rome (28 September-5 October 2014), a festival of science, art and crafts DIY projects organised by Maker Media (the main supporter of the maker movement) that gathered around 90,000 visitors and hosted more than 600 projects and 360 workshops.

2.3 Dialogues on ethics - results

The interviews were conducted with present and former Fab Lab managers or coordinators from Germany, Italy, Netherlands, France, Austria, Denmark and Brazil. The interviewees had distinct commitments or professional relationship with their corresponding Fab Labs, ranging from full-time or part-time staff and volunteers, to advisors and members of some of the Fab Lab network structures such as the International Fab Lab Association or the Fab Academy. Quotes from the interviews are presented in *orange italics*, introduced with a hyphen (-), and separated by paragraph breaks.

The interviewees are also part of distinct types of Fab Labs, including: grassroots-oriented Labs that started with an initial group of enthusiasts or friends with common interest in making or hacking and operate based on an expanded collective of individuals, usually through membership fees supporting everyday expenses; university-based Labs that are supported by specific departments and are thus more used by students, professors or researchers; or Labs supported by public funding from municipalities, European programmes, local and national governments, museums or libraries. Only a minority has

reported private funding or donations from foundations, commercial companies or local stores.

The main activities developed by their Fab Labs greatly vary according to their type and corresponding main source of funding, although they are usually very diversified including DIY projects for private use (from small appliances to curiosities), academic assignments, research projects, artistic pieces or musical instruments, and commercially-oriented prototypes in all domains (robotics, fashion, ceramics, interior design, environment, etc.). Thus, the Fab Labs of our interviewees vary in their focus on individual members or local users, academic population, creative audiences (design and architecture for instance), entrepreneurs or small companies and start-ups.

2.3.1 Democratisation: Engagement with Citizens, Communities and Others

One of the main tenets of the Fab Lab network is the access to tools as a means to democratise the production of technology, which is usually translated in a number of measures to connect to potential users, citizens and communities, and also to other organisations for support, collaboration or partnerships, such as Makerspaces and Hackerspaces, associations such as repair cafes, museums, universities, art and design festivals, libraries, or local and national government bodies.

In this sense, the Fab Labs offer not only an access to digital and manual tools, but also assistance from its staff, volunteers and other users that can be felt as a community based on common interests. One of the interviewees stated that “we have almost no barriers” in contrast with other spaces which tend to be more closed to outsiders, considering “they call themselves an open community but then you enter, they are looking at you, they do not know you, and you almost have to apologise”. In the end, the same interviewee underlined the sense of community as a feature of Fab Labs:

- *Low threshold access, does not automatically mean it has to be for free, or it is not only a matter of the fees [some Fab Labs are membership-based] but it is maybe even more a matter of: do you feel accepted, is there anybody who shows you how to get started with the machines, how to get into the topic, how to get into the community? This is, in my opinion, even more important.*

Most of the Fab Labs concerned in this case study offer workshops or master classes where new users learn how to operate the machines, or they conduct a specific task or project (such as ‘build your own 3D printer’ or ‘your own drone’). In some of them the training is mandatory in order to be a member or to have access to the equipment. There are often workshops for targeted audiences, in cooperation with high schools, museums, youth centres, or small companies. Nevertheless, one of the interviewees mentioned that, for instance, educational use and public access can limit each other, in the sense that the requirements of finishing class projects in certain dates can exclude public access in certain periods of time.

Another interviewee thought that one of the best strategies to engage citizens and communities is to start with a project, and not around a discussion, in order for people to understand what they can do or achieve. He stressed the importance of starting a project in contact with the community and the local context, but at the same time his notion of participation tends to be more instrumental or more practically-oriented:

- *You have participation not because it is an end of itself but because it is a tool. You have participation when you need some specific information that you do not have but the participants have.*

Regarding citizen and community engagement, it is noteworthy the experience of the Mobile Fab Labs, which is essentially a mini Fab Lab with the same machines housed in a trailer or a truck. The first one was built in 2007 by MIT's CBA, but the concept of a 'travelling Fab Lab' has been used in several countries. One of our interviewees works together with her colleagues in a Mobile Fab Lab as an additional activity of their Fab Lab. They got the funding last February from a Business Authority and a private foundation to conduct about 40 events and workshops and 20 projects with companies and entrepreneurs around the country. In this Mobile Fab Lab workshops, anyone can come and get familiar with the technologies, and also get an one-on-one consultation (between 30 minutes to 1 hour) for a specific project they want to develop. Our interviewee reports a very positive feedback, and also subsequent follow-ups from some of those people asking for assistance or advice, or coming to the Lab to further develop their ideas.

A different version is the Fab Boxes, developed by one of the Fab Labs in Austria with funding from the Ministry of Youth, as a mini Mobile Fab Lab where they built small versions of the machines in a box. The interviewee mentioned that the next step is to offer training courses for teachers or social workers, and afterwards the opportunity for them to rent the Fab Box and corresponding materials and develop their own courses. Both the Mobile Fab Lab and the Fab Boxes stand out as effective means not only to communicate but also to engage with broader groups of citizens and communities, or for targeted audiences as small and medium companies, entrepreneurs, or schools.

In a general sense, interviewees conveyed the need to improve communication and participation with other associations. For instance, some of them reported links to Makerspaces or Hackerspaces, considering some of their members belong to these other associations, or develop projects and use other tools available in their spaces. In a particular case, one of the interviewees who is part of a Fab Lab but also another makerspace, stated the need to prevent negative associations to the common idea of a 'hacker' as a criminal or marginal, and as such:

- *We have made a compromise between Fab Labs and hackerspaces and called it makerspace to prevent politicians from saying... it is hard to teach them about the history – no, hackers are not bad guys, so we have just said makerspace.*

In an informal conversation with a participant of FAB10, the constraints of choosing the name of your Lab are often the focus of careful consideration. In his case, the option to call their Lab a Makerspaces instead of a Fab Lab (although they are a part of the Fab Lab network) was a matter of avoiding media and political attention.

It is interesting to notice that some interviewees distinguish Fab Labs from other spaces, by stating for instance, that Hackerspaces are not as integrated as the Fab Lab network as a global community. However, most of them were more fluid about the different designations and possible connections between spaces and labs:

- *They are labs calling themselves Fab Labs and they are rather hackerspaces and some hackerspaces are Fab Labs. I do not see the difference really. Maybe it is a question of whether you identify more with the Fab charter or with hackerspace theory but what I see, and this is the progress, is that it has come together and it blurs more; you cannot and must not divide them apart.*

2.3.2 Trust: Sharing and collaboration

In this section, the principles and practices of sharing knowledge through open collaboration are examined more closely. The questions were focused whether people collaborate within the Fab Lab, whether they share their projects transparently with other users, and finally what type of collaborations occur across Fab Labs. The Fab Lab network upholds as one of its central goals the sharing of people and resources, while indicating in the Fab Lab charter the responsibility of knowledge dissemination through documentation and instruction.

Generally, interviewees acknowledged that people like to show their projects to other people, and in this sense, openness is a basic interest or way of working. One of the interviewees even stressed the significance of interdisciplinary collaborations within the Fab Lab that leads to diversity, creativity and openness:

- *There are artists, designers, engineers, hobbyists, retired people pimping out their model trains, people hacking some electronics and on the next desk you might have shoe designers, so you can be inspired by each other and you learn to understand the thinking of others. It really becomes an open minded community.*

Most of the times, sharing happens informally through random encounters, talks or exchanges of ideas, fuelled by curiosity about other people's on-going projects:

- *In the lab, all people appreciate others asking them 'What are you doing?', giving them feedback from a completely different point of view and this is added value for all of them. They share in this way so that they are very open, there are many open discussions but not that many share it in an informal way so that they put it somewhere online.*

Formally speaking, the mechanisms for sharing and collaboration are still in an emergent stage. In the end, there are no mandatory or formal procedures to ensure collaboration and sharing, but interviewees report the existence of informal group monitoring, where people who don't want to work in a collaborative way, are usually put aside or disregarded by the community. One interviewee who works academically on the topics of open design and collaborative processes considers the Fab Lab as an example of the development of such processes by characterizing it as a place of constant learning. However, in his view:

- *Most open design projects are done by single people, not by teams and not in a collaborative way; we are still at the beginning of that.*

This is a similar view expressed by another interviewee who in turn, is even more critical about the difference between the ideals of sharing and collaboration and the actual practices in Fab Labs:

- *Sharing and collaboration are certainly a big part of the rhetoric of Fab Lab. (...) there is not that much sharing really and not that much collaboration. Collaboration works well when one individual orchestrates it and sharing is quite often this idea that people document their projects to show what they have done, 'Look at my great project', 'Look at what it does' and much less on the nitty-gritty details, how it really works.*

In fact, the practice or non-practice of documentation is a frequent topic within the network. Most of the times, there is a sporadic use of Wikis, Tumblr, or repositories for code and materials concerning the projects that are done in the Fab Labs. To counter this tendency, for instance, one of the Fab Labs in Austria organises a Fab Contest every year, where they ask for applications of projects done during the year in the Lab, and then they select 10-20 for an open exhibition and submit them to a final vote.

A valid argument about the absence of extensive documentation is proposed by one of the interviewees. The physical character of making or manufacturing an object in such settings contains a lot of “implicit knowledge” and “expert-novice exchanges (...) not through textbooks, manuals and tutorials”, which in the end are hard to translate, to document and to share:

- *This idea of documenting and open sourcing documentation and sharing documentation comes very much from the software world. Now the software world is, in one specific thing, different to Fab Labs. In software you always remain within the world of your screen, you code in your screen and you run the code on your computer, you never leave that environment and it is very easy to document the code inside the programme, every programming language has a means to write commands into the code. Now in Fab Labs, we are always switching between the digital design and the material manufacturing and where things go wrong is in the material manufacturing. So we then have to go back to the digital files and change and go back to making. And the ultimate goal is to make something physical and not a digital drawing so that means this very logical and closed connection of coding and documenting is lost in this switch between ‘digitality’ and materiality.*

Regarding collaboration across Fab Labs in the context of its network, there are contrasting views among our interviewees. Some referred to the positive sense of collaboration within the global community, where people are developing projects and forming networks across countries and continents. Others mention the need for more global projects with ‘real’ collaboration, instead of partial collaboration where each Fab Lab is doing one part of the project. The consensual perspective is definitely for more integration across the network, for instance, through the development of platforms or interfaces with a common pool of knowledge for all Fab Labs, or through an expansion of the Fab Academy, seen as a global educational offer where you meet and work with people from other countries.

2.3.3 Empowerment: The Act of Making

In the description of “What is a Fab Lab”, making objects is explicitly defined as a process of learning and empowerment for users: “empowered by the experience of making something themselves, they both learn and mentor each other, gaining deep knowledge about the machines, the materials, the design process, and the engineering that goes into invention and innovation.”¹⁵ Making, fabricating, manufacturing or producing an object is recognised by the interviewees as an activity that enables the users of Fab Labs to learn new skills and to gain a new awareness regarding the possibilities of experimenting and accomplishing their ideas. The general motivation for most users is to bring about their project, which ushers in a new type of thinking and acting:

- *It is normal that if they have an idea, if they want to have something that does not exist, they can make it. This is a way of thinking that usually people do not have.*

This new way of thinking and acting can be defined, according to another interviewee, as an “immediate exposure to materiality”, which may be considered one of the peculiarities of making things in such spaces, as we have referenced in the section on *Values and Practices* in authors as Gauntlett (2011):

¹⁵ <http://www.fabfoundation.org/fab-labs/what-is-a-fab-lab/>

- *In an ideal configuration, they use the lab while developing their products and that means, in the invention and design process, they switch between thinking and making, which is extremely important to get the materiality right. (...) Experiencing material, experiencing material failures in a kind of non-intellectual way (...). It is not through calculations and intellect but it is through touching and feeling it and physical interaction with the material.*

Furthermore, designing and building an object, even if centred on IoT technologies, doesn't necessarily eliminate the use of manual or analogic tools. Spaces as Fab Labs and others can offer a variety of manual tools or techniques such as wood or metal working, and thus function in some instances as small shops or workshops where you combine digital tools with traditional ways of working. This is stressed particularly by one interviewee when he makes the connection to the local circumstances of each Fab Lab and their offer of local materials, techniques or tools:

- *The more you integrate the Fab Lab with the local situation and local context, the better the manufacturing is and you can make almost anything.*

The ability to make something from start to end in a place such as a Fab Lab, in the view of some of the interviewees, enables the users to become creators and producers. For one interviewee in particular, these new trends transform the usual channels for “production” and “invention”. In his view, there is increasingly a shorter line between an idea and a product, because you can bypass the many filters that manufacturers have in place, considering that most manufacturers only include an invention in their portfolio when they ascertain the market for it. Instead, we are seeing the emerging reality of “self-production”:

- *This type of self-producing inventor is certainly a typology we are going to see more often. We see it already happening in design. There are a lot of self-producing designers appearing who no longer rely on the design industry where they try to sell their product, prototype to a manufacturer who then integrates it into the collection and brings it to the market. So these are early signs of that and, of course, designers are much closer to materiality than engineers.*

The issue of gaining control over the surrounding technologies was also mentioned by interviewees, when for instance users gain an understanding of the operating schemes of objects, figure out how to fix them, or find new solutions to repurpose them. In particular, the practices of repair are often the focus of workshops or special days in some Fab Labs, as we will further analyze in the following sections in relation to the issue of sustainability. At an everyday level, repairing broken appliances or devices can be considered as a way to cope with the complexity of the present technological environment. In the Pew Research Center's report on IoT (2014), participants and experts anticipated that this complexity will be too difficult to maintain and evolve well. In the words of Howard Rheingold, a well-known writer and lecturer on digital technologies, “we will live in a world where many things won't work, and nobody will know how to fix them.” (Pew Research Center, 2014, p. 12). It is precisely against this state of technological ignorance and towards a regain of control that the words of one of our interviewees are to be contextualised:

- *I think that when they can repair things by themselves, they gain a feeling of empowerment, of being able to take back control and see an object and think, 'Yes, we can have an impact or control' certainly because it is broken, we can take it apart and see how it works or with the help of others just solder something back in or find a solution and I*

think that is my favourite thing about Fab Labs. (...) Maybe one of the most interesting things to do is to demystify technology.

The sense of empowerment users experience when they realise the possibilities at their disposal in a Fab Lab is also a process of learning about the hitches that are inevitably a part of any making process. As another interviewee expresses:

- *One is the feeling of how much you can actually do in the Fab Lab because you can really do a lot of different things, so this is the surprise of really being able to be empowered to do a lot of things. The other thing at the same time is how it is difficult to do these things. It is not like pushing a button and then everything comes out automatically; you have to design and prototype and test different things and then something does not go well, so it is very important that people understand that they can do a lot but it takes time and experience to do.*

For some interviewees, the experience of actually making something, including all the obstacles, delays and deviations, leads people first to understand the complexity of supply chains and the use of resources, just to produce one chair for example. In the end, many of the interviewees expressed that the act of making can enable most people to move beyond being passive consumers of packaged or commercial products, and to at least be more conscious about the production processes of our things, objects, devices or systems:

- *By making it by themselves they often realise that when something is manufactured there are many ways, or they realise when you buy something it is often hidden.*
- *The main part is about getting away from this consumer thinking, just go and buy stuff, without thinking how it is made, under which conditions they are made and how did it actually end up in the store.*

2.3.4 Social Justice: Diversity and Inclusion

Diversity and inclusion were explored in relation to the issues of gender, age, ethnicity, geographical origin, education, and other social and cultural capital imbalances. While some interviewees held that their Fab Labs were mostly diverse in terms of gender, age or educational background, other interviewees expressed their awareness of a biased group of users, predominantly students, young, male and with an academic background.

It is a situation which is now and again present in public warnings against “digital divide” or “gap”, and now usually going by the name of “diversity”. For instance, the diversity reports released these past months by American tech companies¹⁶, including Apple, Google, Twitter and Facebook, plainly show some of these disparities. With minor differences, there is a prevalence of white and Asian men in their staff, and a wide gender, Hispanic and African American differential. In a brief overview regarding gender, 42% of eBay's employees globally are women, against 37% in Yahoo, 30% in Google, 31% in Facebook and 30% in Twitter. These numbers further drop in leadership (28% eBay, Twitter 21%) or tech jobs (eBay 28%, Facebook 15%, Twitter 10%). Similar scenarios in terms of gender divide are also visible in other technological spaces such as Fab Labs, where the issue is beginning to be analysed towards shifts in gender roles and relations (Carstensen 2014).

¹⁶ See news thread of releases from <http://www.theverge.com/2014/8/1/5958383/ebay-diversity-report-most-gender-equal-tech-company-still-mostly-men>. Accessed 12 December 2014.

In our present case study, one interviewee states that Fab Labs are more diverse than other spaces of the maker movement, such as Techshops or Hackerspaces. Furthermore, the same interviewee was critical regarding the absence of an explicit reference to the issues of diversity and inclusion in the Fab Lab Charter, while underlining the ‘inclusive’ attitude that is informally upheld by every Fab Lab:

- *There is little internal attention to that diversity, little educated thinking about it, little designing it so, it just happened. So I argue that within Fab Labs we really have to be very careful to preserve and develop that diversity. (...) the idea of empowering people to invent is in there [in the Fab Lab Charter], contribution to documentation and learning, to maintenance, health and safety is in there, there is nothing explicitly about diversity. The attitude is inclusive, I would say but it is not a reflective inclusiveness, it is just this well meaning, ‘You are all welcome’ type of inclusiveness.*

Another interview expressed that diversity also greatly depends on the local context. For instance, if the Fab Lab is located in an art and design faculty, the presence of female users will be more probable. In his view, it also depends on how you run the Fab Lab and how you promote it, as an excessive focus on “hard-core electronics stuff” will most probably attract “male engineers”. Maybe a more direct awareness is apparent in the Open Design and Hardware movements, as seen for example in discussions within this community dedicated to the issues of gender and diversity¹⁷, or even the central roles of women in well-known open hardware initiatives and companies (AdaFruit founded by Limor “Ladyada” Fried; Littlebits lead by Ayah Bdeir; and Open Source Hardware Association presided by Gabriella Levine and lead by Alicia Gibb). As another positive sign, a number of non-profit organisations, such as CoderDojo NYC, Black Girls Code or Girls Who Code, or educational networks such as Connected Learning Alliance (Ito et al 2013), are directly addressing learning gaps and gender and ethnic diversity in education, by targeting youth in economically-marginalised communities and neighbourhoods.

As previously noted, in its original mission the Fab Labs were also intended to be implemented in countries or regions lacking access to digital tools, and as such, their history includes an earlier implementation for instance in rural India or Africa mainly through the efforts of MIT’s CBA educational programme. Also one interviewee mentioned that he contributed to the opening of Fab Labs in North Africa through an European programme promoting innovation. Nevertheless, one interviewee expressed his concern over the dangers and limitations of technological transfers regarding distinct countries, contexts, cultures and populations:

- *There are a lot of projects bringing Fab Labs to Africa or bringing Fab Labs to disenfranchised communities and sometimes these approaches are really techno naive. We parachute in the machines and then everything will be solved and then they come with these beautiful stories of this one kid that is completely empowered and runs the lab. Beautiful story, nothing against that but this is not exactly inclusive. (...) It is projecting a model that has been invented elsewhere, based around technology and questions are not asked if that is suitable for that community, for that culture.*

¹⁷ Topic stream 11: Gender and Diversity in Openness, OKFestival 2012. <http://2012.okfestival.org/gender-and-diversity/>. Accessed 12 December 2014.

2.3.5 Responsibility: Ethical Discussions

This section comprises an analysis of a number of ethical issues posed to the interviewees, such as: criteria selection and follow-up of projects; assessment of impacts and contexts of use; experience with unacceptable or inappropriate projects within the Fab Labs; promotion of specific values such as responsibility, social justice or sustainability; and existing mechanisms for decision-making, conflicts of use, responsibility and liability.

Regarding project selection, there are no requirements or formal procedures for basic information to be gathered about the projects to be produced in the Fab Labs. It is usually through an informal process of initial contact and discussion that Fab Lab managers get acquainted with the users and their projects. This contact greatly depends on the operating model of the Fab Lab, and on the familiarity or expertise of the user regarding the equipment or machines to be used. As noted before, some Fab Labs operate mainly through membership, and prospective members have to follow introductory courses before being allowed to use them or become members.

In the specific case of membership-based Fab Labs that most of the times function with a 24/7 access, it is more difficult to have direct knowledge of the projects being conducted in the Lab, for instance during the night or at week-ends. In these cases, members enjoy the freedom to use a chip card, book the slot and use the machines for their projects at any time of day and night. In fact, it is one of the features that attracts users to test and experiment freely new ideas:

- *We are open 24/7; they do not need to ask whether they can use the machines; they do not need to argue over why they use the machines for private stuff, for this or that, but just can try to play around and try out their ideas.*

None of the interviewees reported specific situations where they refused to host or to help with certain projects that they may have found inadequate or inappropriate. One interviewee offered the single example of a user proposing to build a sex toy, and other users refusing to collaborate. The majority of disagreements arises from the refusal or a negative attitude to share or to contribute within the Lab, and not from specific types of projects. As one interviewee noted, the openness of such spaces tends to act as informal control over the projects being developed:

- *I think people realise they do it in public, so they also, you know, it is a very open environment, so if you do something that is really not allowed, then they feel it themselves, so they do not do it.*

Freedom to develop your ideas or projects is highly valued in such spaces, however one interviewee noted that ethical discussions should be developed within the network. The same interviewee underlines how ethical discussions are usually limited for instance to educational projects, where more attention is put into the type of objects that will be produced by kids and teenagers.

- *in a way, you could argue, almost philosophically, that Fab Labs have in a way inherited a certain neoliberal, individualistic stance that you do your own projects so who am I to judge kind of thing. But I think we would need to develop these kinds of discussions. (...) So, in educational circles we do have these kinds of discussions, you know, what are good projects for students to work on to actually be able to receive that empowerment, instead of locking them into some kind of, 'Oh, this is a machine to make key chains'.*

In the end, the same interviewee referred to the notion of ‘critical making’ to describe a more careful attention to the purposes of making something, which relates to the notion developed by Ratto and Boler (2014) of “an activity that provides both the possibility to intervene substantially in systems of authority and power and that offers an important site for reflecting on how such power is constituted by infrastructures, institutions, communities, and practices” (p. 1). For our interviewee, social sciences and arts possess this critical thinking which is still lacking in most engineering and design practices:

- *You know in social science and the arts, critical thinking is part and parcel of what you do, not so in engineering, not so in industrial design and I think that engineers and designers are losing out on something.*

In terms of prescribed rules within the Fab Lab network, the Fab Lab Charter is as a common guideline for all Fab Labs, although most of its elements are considered to be “broad” in their formulation and suggestions for action. Thus, most Fab Labs follow their own shortened versions for managing their everyday operations, as it is visible for example in the rules of one Fab Lab in Germany, as stated by one of the interviewees: 1) you are responsible for yourself, 2) you can only use machines if you follow an introductory course, 3) you have to clean up your stuff. The Fab Lab charter is referred to by one interviewee in an older version, where it was stated that you couldn’t make something that was harmful to others. However, the interviewee expressed the difficulty in ascertaining these situations due to contextual or cultural differences:

- *But of course it is very difficult; it depends on the context. So I had one student, for example, who told me, ‘I want to do a traditional knife’. I said, ‘Err, yes, okay, but maybe it is a weapon?’ He said, ‘Yes, no, but it is traditional (...). Okay, so in this case maybe it was okay but, of course, we came from different cultures.*

When questioned generally about objectionable types of projects, most interviewees made reference to the controversy over 3D-printed guns, a topic that attracted significant media attention and accordingly several requests from journals and TV stations to some Fab Labs. Here the interviewees acknowledged a discussion within the community and a subsequent consensus on the topic, also ascribing those projects to a sparse number of individuals:

- *There was really an unanimous reaction everywhere that, ‘No, we are not going to do that’ (...) So we really had an answer to that and the answer was a clear no.*

Besides this specific situation, again the Fab Lab community privileges the freedom of its users to pursue their own ideas and projects, without judgement, as another interviewee also recognised above, and thus the absence of formal rules or procedures:

- *My general approach is that any idea, I cannot tell whether this is a good idea or a bad idea, so any idea is worth trying out as long as it complies somehow with the law. However, there are no further rules from our side. We are open and we are happy about people who share their projects and make it open source but we are also happy about people who launch a product and make a lot of money out of it.*

On the other hand, it is interesting to note that the company UPS has established policy guidelines regarding its 3D printing services, offered in 6 US locations since September 2013 and planned to expand to more than 100 new stores across the country. UPS has thus a list of banned or prohibited items that can’t be 3D printed in their stores, including “guns, gun parts, gun receivers, etc.”, “anything intended to be used directly or indirectly for missile or rocket systems activities or end-uses, including design, development, production, testing or

use of rocket systems (including ballistic missile systems, space launch vehicles and sounding rockets) or unmanned air vehicles (including cruise missile systems, target drones, and reconnaissance drones”, or “anything intended to be used directly or indirectly for chemical or biological weapons activities or end-uses, including design, development, production, testing, or use.” (Wehner, 2014)

As previously noted, Fab Labs host a great variety of projects that range from private use to community or commercially-oriented purposes. Specifically, the pursuit of projects that promote values such as responsibility, social justice or sustainability, aren't usually an explicit priority or stated purpose for most Fab Labs. This is consistent for instance with a recent survey on Repair Cafés and Hackerspaces around the world conducted between May 2nd and May 30th 2014 (Charter & Keiller, 2014). Repair Cafés usually host and support repairing activities in their own independent space or usually within other Makerspaces, and also includes modification to clothing, and upcycling of electrical and electronic equipment and components. In their findings, volunteers at Repair Cafés are most strongly motivated to help others live more sustainably, to provide a valuable service to the community and to help improve product reparability and longevity. But Hackerspace members, although interested in sustainability, are essentially motivated to be part of such a space because they want to meet others with common interests, to be intellectually stimulated and to learning new skills, which is also consistent with some of the tenets of the hacker/maker philosophy we previously made reference to. However, this study still indicates that activities pertinent to sustainability or circular economy, such as repair, upcycling or home energy monitoring and control, still have their place in Hackerspaces.

One interviewee recognises these concerns in some individuals, and another interviewee sees them starting to appear more visibly in particular case, referring to the example of the Green Fab Lab in Barcelona. Most interviewees mentioned their own concern with more sustainable practices in the Fab Labs, and in some cases also users' attention to resource management when they are, for instance, laser cutting something with wood waste, or when they come to repair their own appliances or devices:

- *Personally, advocating for resilience and self reliance usage, like being able to manufacture things, it is much more resilient in the near future in which we will not be able to import goods from all over the world. It is always satisfying to make things by yourself.*

One interviewee gave more concrete examples of projects made in the Fab Lab that promoted sustainability, such as up-cycled skateboards, that is, building skateboards from old snowboards and employing former prisoners, and also a low-cost water disinfection system by sunlight, to be used for instance in underdeveloped regions:

- *It is a wonderful story. They made the first prototype in the lab, the electronics in the lab, and last year they produced their first 200,000 pieces, not in the lab but they would not have started without the free and easy and low barrier access to our lab and the community to discuss the ideas and share.*

Sustainability is a recurrent topic of discussion in some Fab Labs and in other Makerspaces. Digital fabrication can be seen to encourage more sustainable production processes in terms of resources needed, local origin of products or extended life cycles. Nevertheless, the discussion also includes the limitations of such spaces for supporting sustainability (Smith et al., 2013) for instance in dispersal of production capacity, diminished scale efficiencies, and intensified consumption through more personalised goods. On one hand, “if we can have exactly the products we want, tailored to our needs, and the ability to easily repair and repurpose most of these objects, chances are that most products' life cycles will be greatly

extended. The ability to have something manufactured only when and where it's needed would also considerably decrease fuel consumption, pollution and surplus waste. On the other hand, precisely the fact that products can be made at the push of a button may lead us to regard them as disposable and easily replaceable, thus decreasing the product's life cycle and greatly increasing the amount of waste." (Mota, 2011)

In what concerns the internal processes of discussion, decision-making and conflict management, there are no common procedures followed by all Fab Labs. For instance, in one of the membership-based Fab Labs, the interviewee stated that there were in place both formal and informal mechanisms to deal with the selection of members (two members have to endorse you) and for decision-making (through majority of vote in regular meetings, mailing-list, and more official meetings):

- *The way we decide things is that we have a member meeting and basically anyone can vote. So of course sometimes people do not agree on things. So we had one or two occasions where things escalated a bit, but overall we did not have really problems. (...) So we have these weekly meetings where we just discuss things informally, but if you really want to decide something, if we want to spend some money on something or so, we have this official meeting and we have to invite people two weeks in advance and we have to announce what we will be talking about. So it is a mixture.*

Regarding mechanisms of responsibility and liability, most Fab Labs have in place a basic set of rules to use the available machines, such as introductory workshops, training for members, or informal learning with staff members or volunteers who offer technical support if time and resources permit. Most interviewees expressed the view that more formal mechanisms for responsibility and liability is a serious topic to think about in the future, although their concern differs from country to country highly depending on the type of Fab Lab, activities and legal status. Generally speaking, most of the times there are at least insurances for accidents and other incidents for the staff, while individual users or members assume the responsibility for their activities in the Fab Lab.

2.3.6 Democratisation: Purposes and strategies

This section included more open-ended questions to the interviewees about the goals, priorities and perceived changes of their own Fab Labs and the Fab Lab network, and also a discussion on past, present and future funding models for Fab Labs as a whole.

Most of the interviewees expressed the view that Fab Labs are powered by the desire and passion of their users to making things, that is, to solve problems, to tinker, to experiment or to hack. In this sense, the Fab Labs serves an ideal of "democratisation of knowledge and learning", and in the opinion of one of the interviewees, they might have a disruptive impact in the production cycle:

- *What we are doing in Fab Labs might be as disruptive to manufacturing as was MP3 and Internet to the music industry (...) we are exploring an area that might become really important for industry and other sectors of society in this kind of global experiment, global self-inflicted experiment.*

Some of the interviewees expressed a more political and philosophical understanding of Fab Labs or the maker movement, making reference for instance to capitalist critiques of production and power dynamics. In their view, Fab Labs offer an alternative model for local

and micro production, also based on the realities of open source, peer-to-peer production and collaborative commons (P2P Foundation, 2012).

Regarding the Fab Lab network more specifically, one interviewee mentioned an enhanced awareness that arises from a global network, regarding for instance more knowledge about issues that can affect other distant countries. The same interviewee also mentioned the benefits of learning about and accepting cultural differences within such a global network.

Most interviewees valued the openness of the network regarding the independence of each Fab Lab. This is further supported for instance by the absence of any mandatory requirement to attend the annual conference, finish the Fab Academy, or perform other formal tasks within the network. One interviewee in particular underlined the importance of keeping the network as open as possible in the near future:

- *It is important is to keep it open in a way, so that each lab can find its own way. It is a progress; there is no best practice. (...) the main thing is keep it open, help the users to get in, to provide training and to show them and, this is probably the most important thing, show them that it has never been so easy to make and it is easy. It is not rocket science to make something.*

However, some interviewees disregarded cooperation between their Fab Lab and other Fab Labs from different countries, and tended to focus more on their local or national links to other Labs, Hackerspaces, etc. In these cases, they value physical proximity and local support, and expressed their view that instead the Fab Lab network is more about discussion of models and exchange of abstract ideas. One interviewee clearly expressed this disconnection from the network and the importance of everyday contacts and activities with local users:

- *For the ordinary Fab Lab user, it does not really have an impact at all. We are really a local community. Of course we have some people visiting us from nearby Fab Labs and they know them and so on. But it really does not make a difference if, like, if you are interested in a special subject, if you get the knowledge from another Fab Lab or if it is just like a hackerspace around the corner or it is a website also. For our community I think the network of the Fab Labs does not solve our day to day problems. Because you are talking to remote people and the good thing about the local community is, it is different, you really can talk to people, you meet them and they can show you something.*

For one interviewee, the Fab Lab network is in fact a mix of bottom-up and top-down perspectives, or as he prefers to phrase it, with a centre and a periphery where you have different distances from the centre, and you start at the outer part and you move inward towards the centre. Another interviewee is more critical regarding the centralisation of control from the MIT over the content of the Fab Lab Charter for instance, and considers the Charter “very unilateral”. On one hand, in the view of this interviewee, the network should encourage more “openness” and “lateral interconnections”, instead of “traditional answers of hierarchy and global and national chapters”, but on the other hand, another interviewee thinks that the network is mostly decentralised and needs more coordination.

In what concerns the different models for Fab Labs, most of them operate as local associations, foundations, or as one interviewee stated, as “geek clubs” sometimes. Their way of operating and funding their activities is a matter of constant discussion. Some of the Fab Labs sometimes follow a hackerspace philosophy by cultivating an independence from public funding or other funding. As one of the interviewees stated, “we wanted to be

completely independent”, which is in fact a strategy for survival when external funding ends or is interrupted. Many expressed their concern regarding the end of public funding that might cause a Fab Lab to close, also because it didn't manage to create a community able to support in the long run:

- *I feel more comfortable if I have a self-sustainable system because then I can look forward and do the next step without always having in mind that they might cut the funds and close it down next year.*

In practice, Fab Labs have a diversity of models of development and funding, some of them self-funded through individual memberships (one of most successful Fab Labs using this model is Happy Lab from Vienna, Austria, with more than 1,000 members), and others implemented through European programmes, university funds or private foundations. Some interviewees find the most successful models to be either university affiliation, either public funding although in their view the latter requires a lot of time dedicated to grant writing and submission, with long periods of uncertainty.

A future model for Fab Labs could be a mix of for-profit and not-for-profit models, as voiced by another interviewee. The majority of the interviewees didn't express any objection to private funding of Fab Labs, such as renting the space or prototyping services to companies, having company-funded Fab Labs, or larger corporations giving grants to Fab Labs. This is a point that needs clearer clarification, considering that the Fab Lab Charter clearly states that commercial activities can be prototyped and incubated in a Fab Lab, but they must not conflict with other uses and are expected to benefit the inventors, labs, and networks that contributed to their making and success. However, as we have seen, there are no clear follow-up of projects and initiatives that begin in Fab Labs, which clearly limits in general the attribution of benefits to the Fab Labs.

In fact, a number of controversies over funding have risen in some DIY and maker initiatives and projects. For instance, the SpaceGAMBIT funding by the Defense Advanced Research Projects Agency / DARPA was a controversial topic on its own, and most importantly, in relation to discussions on military funding of DIY and maker initiatives, usually through education programs (O'Leary, 2012). The most visible controversy occurred when the Manufacturing Experimentation and Outreach / MENTOR program developed by Dale Dougherty of O'Reilly Media (publisher of Make Magazine, and organiser of the Maker Faire) and Saul Griffith of Otherlab, received a \$10 million DARPA award, with the aim of bringing the practices of making into education and extend the maker movement into 1,000 high schools over three years.

An ethical discussion among the maker community followed this announcement. Mitch Altman, a renowned figure in the community and co-founder of San Francisco's hackerspace Noisebridge, strongly expressed his disagreement and subsequently decided to leave the organisation of Maker Faire. In a text affirming his ethical standing (Altman, 2012), he straightforwardly rejected the choice of accepting funding from military organisations, even for education purposes: “children who are educated with DARPA funding are probably more likely to think that DARPA is a good thing, and are more likely to work for DARPA, or other military organisations. Is this a good trade-off? I don't think so”. Instead, Altman argued for alternative sources of funding from organisations or foundations that would be better aligned with the goals of the maker community. In his words, “the goals of the MENTOR program are laudable: introducing new design tools, teaching the collaborative practices of “making” to high school students, and creating “makerspaces” in schools. These are not the goals of DARPA – though there is some overlap, in as much as this helps DARPA increase the number of quality engineers at their disposal”.

Only one interviewee made direct reference to this backlash regarding the DARPA grant:

- *We do not have that many people within the big Fab Lab network who would actually do that. Many of them do not even care and that is a pity, I think they should care.*

In fact, the Fab Lab Foundation that supports the international Fab Lab network generated a controversy of its own in June 2014 by accepting a \$10 million grant from Chevron Corporation¹⁸. Based upon the grant, it will open up to 10 Fab Labs across the US in the next three years, located in areas where Chevron operates, including the first two facilities in Bakersfield and Richmond, California. The aim is to provide approximately 20,000 students and adults hands-on science and technology experiences. In the words of Neil Gershenfeld, Chairman of the Fab Foundation's Board, "along with launching new fab labs, Chevron's grant will help build the Fab Foundation's capacity to provide access to digital fabrication across the country and around the world".

The same interviewee mentioned this Chevron's grant and expressed concern for the dangers of "fab-wash", while advocating more discussion and transparency within the Fab Lab network about this type of situations:

- *'Oh, that is nice, we can open ten Fab Labs and run them for four years' or you could say, 'Chevron in the US, that means fracking and water pollution and extra earthquakes and that is completely unsustainable so they want to fab wash their activities, do we want to have that?' The answer is somewhere in-between but we didn't have to have that fab wash discussion (...) because you need to have long spoons when eating with the devil and in my view certainly the old companies, are the devil. (...) We are lacking that critical attitude, you know? Nothing wrong taking the money in the end but the terms in which who decides on what, that really has to be discussed and I think has to be made transparent.*

Another interviewee had a more pragmatic attitude towards private funding, or the Chevron case, by arguing for the need to distinguish different types of spaces, and thus differentiate Fab Labs from other types of Labs:

- *My practical thing is, then do not call it a Fab Lab. Call it the ChevLab or something like that, you know, and then you can continue the discussion and in two years you will figure out, 'Okay, but the ChevLabs are indeed, they are real Fab Labs or not.'*

In Europe, the question of funding for Fab Labs is also a matter of central interest for the sustainability of the labs, and is connected to access to public or private funding from European, national or regional programs and organisations. Several Fab Labs have received funds or grants to pursue their activities for educational, entrepreneurial or even specific regional aims. For instance, from 2011 to 2014 the project "Fab Labs in the border region" was funded by the Interreg IV-program between the Netherlands and Flanders (European Regional Development Fund) to establish two new Fab Labs in Genk, enable another in Eindhoven and expand two other Fab Labs in Leuven and Maastricht. Coordinated by KULeuven (Catholic University of Leuven), the project presented the Fab Labs as educational workplaces and innovation settings, where students and individuals can create a product prototype and start a business¹⁹.

¹⁸<http://www.fabfoundation.org/2014/06/the-fab-foundation-launches-new-fab-labs-in-the-us-with-generous-grant-from-chevron/>. Accessed 12 December 2014.

¹⁹http://www.limburg.nl/Actueel/Nieuws_en_persberichten/2011/Oktober_2011/Europa_investeert_5_miljoen_euro_in_grensoverschrijdende_projecten. Accessed 12 December 2014.

As another example, in November 2013, the Danish Industry Foundation granted the Center for Participatory IT at Aarhus University three million DKK to fund a new research project, called Fab Lab@School, in collaboration with Stanford University, and also VIA University College, Microsoft school network, Spinderihallerne and school management in Silkeborg, Aarhus and Vejle municipalities. The project aims at developing children's competencies in digital media by giving them access to the newest technology and educate them on design and innovation. In the first of the three initial workshops, stakeholders and future managers of Fab Labs learned about how to establish a Fab Lab in the three municipalities involved, and teachers also got acquainted with new maker technologies and kits, such as LilyPads and MakeyMakey²⁰.

As a last example, Ashton Community Trust (Belfast) in partnership with the Nerve Centre (Derry/Londonderry) officially launched the first two Fab Labs in Northern Ireland²¹ on May 2013, with funds by PEACE III managed by Special European Union Programmes Body. The Fab Labs will offer support on a local basis to communities, entrepreneurs, students, artists and small businesses, but the funding agencies also have a specific scope. The Special EU Programmes Body is a North/South Implementation Body sponsored by the Department of Finance and Personnel in Northern Ireland and the Department of Finance in Ireland. The PEACE III Programme, funded through the European Regional Development Fund, also has a specific scope. It is designed to reinforce progress towards a peaceful, shared and stable society by promoting the reconciliation of communities in Northern Ireland and the Border Region of Ireland.

Particularly these discussions over funding and management models that have punctuated several networks in the DIY/maker movement are bound to continue and even to expand considering the rise of such spaces and labs.

²⁰<http://cavi.au.dk/news/enkelt/artikel/Fab-Labschooldk-workshop-challenges-schoolteachers-to-program-lilypads-and-robots/>. Accessed 12 December 2014.

²¹<http://Fab-Labni.eu/>. Accessed 12 December 2014.

3 Civil Drones²²

3.1 On drones

Remotely piloted aviation systems (RPAS) or, more commonly, ‘civil drones’ are aircraft systems that operate without an on-board pilot, controlled by a remote pilot, an autonomous navigation system, or a combination of the two. The systems vary significantly in their size, complexity, quality and capabilities. Interest in the potential of the technology has been accompanied by calls to support the establishment of a European civil drone sector while maintaining a safe and responsible development path.

While there has been substantial debate about the ethics and societal impacts of military drones (e.g. Billitteri, 2010), such studies of civil drones remain sparse. Sparrow (2012) explored the ethics of dual-use research in drone development, and Boucher (2014b) considered the way the connections between civil and military drones are treated in strategies for managing public acceptance of civil drones. Several studies have considered the potential impact of civil drone development upon civil liberties, most thoroughly with reference to surveillance, privacy and data protection (see Finn, Wright, Jacques, & De Hert, 2014; Bracken-Roche et al., 2014). Other areas have been subject to sporadic analyses, such as policing (Salter, 2014; Straub, 2014). Several studies have called for greater and more meaningful public deliberation on how civil drone development (e.g. Boucher, 2014a; Gersher, 2013; Hayes, Jones, & Töpfer, 2014).

The strategies for managing civil drones in society devised by the European RPAS Steering Group (ERSG, 2013b) hold that it is “important to modify the vision of “killing machines” they have right now due to the actually military-specific utilisation and to some catastrophic movies” (ERSG, 2013a, p30). The proposed solution is simple; “give to the citizens a different vision” (ERSG, 2013a, p36). The ERSG approach is considered representative of a sentiment often expressed in industry and policy circles where concerns are raised about potentially damaging public opposition civil drones. This has been criticised in previous studies (Boucher, 2014a, 2014b) for being based upon assumptions, since there have been no studies of citizens’ vision, nor of their provenance. Perhaps more problematic is the invoked conceptualisation of technology in society, which sees the citizen as a once empty vessel, that has been given a vision that is not compatible with acceptance and that this vision should be removed and replaced with one that is more convenient. The approach is at odds with contemporary understandings of technology in society, and with the European agenda of responsible research and innovation (RRI, see European Commission, 2013; Stilgoe, Owen, & Macnaghten, 2013; von Schomberg, 2013).

In response to these problems, it has been argued that the burden of acceptability should be shifted from the citizen to the technology (Boucher, 2014a). That is, from focussing on how to make citizens accept civil drones, to focussing on how to make civil drones acceptable to citizens. This requires a deep understanding of citizens’ expectations, visions, hopes and fears for their development.

The research described here is positioned in response to this need. We conducted focus groups with small groups of citizens to examine the robustness of the assumptions described above, to explore how these citizens make sense of civil drones, and to consider the kind of development they would (and would not) like to see. Through these sessions, we gained

²² An extended version of this case study is described in another forthcoming report by Boucher, P. (2014) *What comes to mind when we talk about civil drones?* European Commission, Luxembourg: EUR 26824 EN only available at request.

several interesting and, often, counterintuitive insights. These may be useful in supporting on-going developments in the field, and could be used as a starting point for larger public engagement projects.

3.2 “Ethics Dialogues” – methodology

In this section, we describe the overall structure and methodological design of the “ethics dialogues”. We have implemented ethics dialogues through a well known group interview method, called “focus groups”. In these “ethics dialogues” we sought to explore ethics of civil drones through the following issues:

- What visions, narratives and metaphors are used to make sense of civil drone development and where do they come from?
- What first impressions of civil drones can be identified?
- Which applications are considered acceptable and which are not, and how are the boundaries of acceptability defined?
- How robust are the assumptions implied in the strategies for managing public acceptance of civil drones described in the ERSG (2013) roadmap

Four focus groups of around eight participants with no prior knowledge of civil drones, lead to productive group discussions covering a range of topics, while remaining adaptable enough to explore emerging ideas and focus upon the points that matter most to the group. We facilitated the discussion by providing information for the groups to discuss and asking open-ended questions, most notably of the form ‘*what comes to mind...?*’.

To do this effectively, we needed to design a script for the facilitation of sessions to ensure the discussions were productive without sacrificing flexibility. Since the participants were not expected to have pre-existing knowledge of civil drones, we had to provide some information for them. The information highlighted a range of potential applications without pointing directly to social or ethical problems that have been identified in the literature (such as privacy intrusion and dual-use). This way, we maximised the opportunity for the participants to decide what was important to them and express their reasoning in their own terms, a task that would not be possible in a quantitative survey, for example. This is not always easy with non-expert participants who are often not accustomed to the subject or format of discussion.

During the design stage, we conducted a pilot focus group. This was performed inside the JRC with four volunteer colleagues. The purpose of this pilot was to test run the structure and design of the session, to ensure the texts and videos were understandable and useful in stimulating discussion, to check that the timing was appropriate, and to offer an opportunity to consider how the method could be improved. We did not record or analyse these sessions, and do not refer to them any further here.

Following the pilot, we further developed and finalised the script and the selection of materials that were used in the session. The appropriate selection of materials and the design of how information is presented to the participants is crucial, because it introduces biases. This is unavoidable, but we sought to select material that was quite descriptive without being excessively normative or judgemental in its content. The task was to balance the need to give participants enough information for them to consider the technology in a useful way, without persuading them to a predefined perspective. In many ways, the selection process was guided by the RRI principle that citizens should be informed about the

motivations for and expected consequences of the given innovation process. (see Boucher, 2014b).

The final step was to organise the sessions themselves. We completed three two-hour sessions in the UK and one in Italy, contracting local companies to recruit participants, provide a venue, and to transcribe the sessions. The contractors offered participants financial incentives to attend, and took responsibility for managing informed consent and compliance with data protection laws. We had no direct contact with participants outside the discussions themselves, and had no access to any personal or identifying information. We did not request participants to be perfectly representative samples of the wider population but, rather, focussed on a diverse range of citizens in terms of age and social background, with a roughly balanced gender profile. To minimise bias in the perspectives of participants, they were not made aware that the subject was civil drones until the session had already started. Advertising the subject may have attracted those that already held strong views, discouraged those that had little knowledge, or tempted the participants to research the subject before joining the group, which may have affected the opening stage of discussion on their first impressions. During the sessions we have used pictures collected from various websites, and videos from YouTube, as well as text taken from European Commission and the Ministry of Defence (UK) documents. Texts were slightly modified, e.g. to remove acronyms.

Following a purposeful designed script, each session was structured into six stages, each designed to consider specific aspects of civil drone development. The first stage was an opportunity to explore participants' early impressions of the technology, before any substantive information was offered via the mechanism of the focus group itself. This allowed us to learn about their pre-existing knowledge, assumptions and perspectives, which is relevant to the examination of the assumption, described above, that citizens hold a 'killing machines' vision. The following three stages were based upon the three identified motives for (and expected consequences of) European civil drone development, as identified in previous analyses (Boucher, 2014b), specifically the functional benefits, the economic benefits, and the benefits accruing to military drone development. A fifth stage was included to explore the video capabilities of civil drones. This was designed as an opportunity for participants to raise ethical concerns, although we did not prompt the participants by introducing privacy as a concern they should hold. Rather, we allowed them to raise it if they wished and to articulate any such concerns in their own terms. The final stage of the sessions was dedicated to reflections. Here, participants were left to discuss together in small groups, before sharing their overall impressions and describing which questions were most important to them.

During each stage, the facilitator's role was to maintain a useful discussion amongst the participants. At a basic level, this involved allowing discussions to develop when they were considered interesting or important and moving discussion along to the next stage when necessary. In practical terms, the facilitator had to manage timekeeping and the timely introduction of text and video information that was used to inform the discussions. Perhaps the most challenging aspect of maintaining a useful discussion was to maximise the opportunity for participants to express their perspective in their own terms. This means minimising the facilitators influence upon the participants' judgement. This was addressed during the design stage, with the selection of information (describe above) and decisions about how to question participants. Leading questions were avoided so, for example, we did not ask whether participants felt that civil drone development would affect their privacy. Instead, we asked what came to mind when they considered the technology, and how they imagined civil drones in the future. When participants raised points directly to the facilitator they were asked to elaborate further, or the point was presented back to the group by

asking whether they agreed or had a different perspective. This was usually enough to stimulate discussion. When discussion began to subside or become repetitive, we moved to the next stage.

The discussions were rich and open, and the participants raised many interesting points that were often contrary to the dominant assumptions as well as the expectations of the facilitator, such as the response to the relationship between military and civil drones. We were also satisfied that the participants were able to raise some of the ethics/societal concerns already identified in the literature, such as privacy intrusion, chilling effect, and citizens' role in shaping development. We consider this a sign of success, demonstrating that the participants' ability to identify and explore the points that were important to them. Since these concerns were articulated in the participants' terms, the insights can be used to develop appropriate responses. Insights from the focus groups are presented in the following section, before further discussion and concluding recommendations.

3.3 Dialogues on ethics – results

In this section, we present insights from the focus groups. The most pertinent points from each focus group with a focus on ethics are presented. First, we presented the participants' first impressions of civil drones, their insights before receiving any detailed information about the technology and its application. This is followed by a section describing different visions articulated by participants, including metaphors and narratives used to make sense of civil drones and projections of the impacts of their development, both positive and negative. A third section describes participants' insights on acceptable and unacceptable use of civil drones, including how they define the distinction between the two. The fourth and final section describes participants' final reflections, including proposed solutions to the problems that they identified.

Direct quotes from the focus groups are presented in *orange italics* and separated by paragraph breaks. Most often, the selected quotes are taken from a single statement made by one participant. These quotes are introduced with a hyphen (-). Where the quote refers to several participants, letters are used to indicate which participant is speaking. Where the facilitator of the session is cited, the quote is marked as *FAC*.

3.3.1 Ethical Concerns

As discussed, in the first part of the focus group we asked participants 'what came to mind' when we introduced the subject of the focus group as civil drones. Some participants had heard of the technology through applications that were reported in mainstream media, while others had no knowledge at all. Nonetheless, almost all the participants had something to offer as a first impression.

Surveillance

For many, the first thing that came to mind was surveillance applications:

- a. *When I think of drones, I think they're out there to watch over us.*
- b. *It's mostly purely for surveillance then, I presume, are they?*

This was sometimes expressed as a concern for excessive invasions of privacy:

- *My first response is concern and worry. It's eyes in the sky, isn't it? There's something a bit disturbing about it all.*
- *The first thing I think of is whether our privacy is going to be invaded, a bit like 'big brother', really.*

Often, such invasions were accepted as an inevitable extension of current surveillance practices, particularly CCTV.

- *It depends what it would be used for. CCTV is everywhere; you just sort of get used to it and accept it, you know, that sort of thing? I don't want it to be too intrusive.*
- *I think it's just a matter of time before this starts coming; you know, five or ten-years. Everything's going to be recorded. They reckon you've been caught on CCTV X amount of times anyway in a day so, to be honest, I don't think it makes that much difference.*

Often, participants referred to popular films and TV shows which came to mind when they thought about 'drones'. Here, a participant is reminded of *The Truman Show*, which presented a vision of a particular kind of surveillance society. Here, the film is invoked not because of the use of civil drones, but because of the idea of extreme surveillance.

- *It reminds me of the Truman Show. You know, the Truman Show where there are cameras on every street, where he was watched? It reminds me a bit like that.*

Two separate references were made to *Enemy of the State*, which also presents a future society under extreme surveillance.

- *It reminds me of, have you seen the film 'Enemy of State', where they listen to your phone calls?*
- *You know, it absolutely screams of 'Enemy of the State' and so many other films like that.*

In this excerpt, a participant refers to the *Flintstones*. This appears to be more to do with the idea of the skies being congested than the film. It is not clear why the participant was reminded of the *Flintstones*, but this vision of civil drone development is explored further in the later section on *full skies*.

- *Didn't they have that in the Flintstones movie, where they had them things? That's what it will be like. We'll be going to work, doing our thing, and we'll look into the sky and there will be all these things flying around. Oh, it's crazy.*

Other references to drones used in film and television were more fleeting and did not appear to have a strong influence on their perspectives, for example the following reference to *Thunderbirds*.

- *It's like Thunderbirds! Does anyone remember Thunderbirds!*

Misuse

Participants were concerned that people would misuse the technology to cause trouble.

- *You'd get a lot of mischief, wouldn't you? [agreement]*

Often, these worries were part of a specific vision of civil drones in society. For example, the following quote shows how a vision of many drones being used simultaneously was seen as vulnerable to misuse, in this case for deliberate attacks.

- *It's slightly unnerving, thinking of all these things flying around. Someone could just stick lasers on them and start zapping people.*

The previous example may appear unrealistic, perhaps based upon a misunderstanding of what civil drone development is predicted to be like. It is important to note, however, that this does not mean that these perspectives are less relevant for policymakers. While such specific concerns – for example about lasers – may not be considered valid from a scientist or engineer's perspective, they do capture citizens' misgivings about the technology on the basis of their vulnerability to present nuisance. In these terms, they demand reflection on how to ensure that citizens are protected from misuse. Several other examples where participants identified potential nuisance associated with drone development were grounded very much in the present reality of drone availability. For example, the incident at the football game, described in the previous section, was raised by several participants as an example of how drone technology can be misused to cause nuisance. In the following extract, we see a typical exchange on how the benefits of civil drones – in providing better viewing angles for football – is traded off against their vulnerability for misuse.

- a. *Why would you want to do that at a European football game? It's just caused loads and loads of trouble. It just shows you though, if they cost £600 or £700, some people have daft money to spend on daft things really. I mean, who'd have thought of doing something like that? If they were used properly though, because that was just someone larking about with it, you'd be able to get better angles for the shots and stuff, so it would enhance the football.*
- b. *Yes, but it wasn't done for that. It was done to have a go at each other.*
- a. *To antagonise and scare, yes ... that was just some plonker that did that at that football game, but I think they've got the uses.*

Also here, participants referred to popular films and TV shows which came to mind when they thought about the technology. For example, one participant's perspective appears to be influenced by drones used in the television series *Homeland*, leading her to worry that that they may be hijacked by terrorists and used against us. Concerns about terrorist use of drones are considered in a dedicated section below.

- *I watch a lot of crime scene stuff and, I think it was Homeland, there was one about an unmanned aircraft and someone hacked into the army's database and took over the pilot's unmanned aircraft. They sent the bombs, so things like that could happen; someone could hack into these unmanned aircraft and if they are equipped with rockets ... then it could be a massive problem.*

Security

Continuing from this theme of nuisance and misuse, participants frequently cited the possibility of using drones to enhance criminal activity. In the following examples we see reference to theft, both of private institutions and people's homes.

- *Criminals could easily pick up that though, couldn't they? Like I say, for looking at banks and security guards and all sorts of things.*

- *You just don't want criminals using it to watch your house and things ... I bet there's people now going online and going, 'look at them drones. We can do a job with that – look at that!'*

In the context of using drones for security purposes, participants raised that criminals could counteract security drones with their own devices. Here, we also observe a demonstration of a military vision of civil drone development.

- *The criminal could have his own drone and just attack your drone. They could have one waiting as it comes out and then just fly it into it [agreement]. They could have weapons and just start, like, shooting at the drone.*

Finally, here, we see how the drones themselves may be vulnerable to crime, referring to the 'delivery drone' example in the Amazon video.

- *Shoot it down with a BB gun; you've got yourself a free DVD. [Laughter and agreement].*

Integrity

Participants were concerned that drones could be used for stalking victims or for collecting images of children. The groups recognised that these activities would be as illegal with a drone as they would be in any other circumstances, but felt that the drone offered new capabilities and would be difficult to regulate.

- *You know, if you have a psycho boyfriend and he's stalking his ex-girlfriend or something, do you know what I mean? Yes, stalkers would be all over this, wouldn't they? It would be outside her house every day, following her to the bus stop, following her to work.*
- *We're all decent people in the room but obviously there are plenty of people that aren't decent people, so what they want to do with it, whether it's to perv' on someone or attack someone, there are plenty of reasons that I think you shouldn't do it.*

Participants also raised the possibility of civil drones being used by paedophiles to collect images of children without being detected.

- *You could have pervs watching kids. How would you ever know? You wouldn't. Hovering above a playground at all times, if it flies over a playground.*
- *All these paedos that aren't allowed near children's schools will soon be able to. They're going to love flying the bloody thing over it. [agreement]*

Vulnerability - Children: Safety and Misuse

Participants considered the combination of children and civil drones as problematic for two key reasons. First, that if children are controlling drones (perhaps those of a model aircraft type), they may lose control of them or use them for deliberate mischief. Several participants were surprised to learn that model aircraft 'toy drones' were widely available and within the budget of many Christmas shoppers. This scenario was expected to lead to incidents of misused (both deliberate and accidental).

- *I'd be concerned about who's controlling that. If a kid was flying that around my head and it bashed into me, I wouldn't really want it*

flying around me. Who's controlling that, to say that they can control it safely? That would be my concern.

- *There will be drone crashes [wide agreement].*

Further, participants raised that even responsible uses of civil drones could be risky if used around children, who may attack them and cause accidents.

- *I think they'd be targets, me. Kids would be throwing stones at them if they really took off and, like you say, if they were buzzing all over the place.*
- *Wouldn't we have all the kids on the estate trying to take them out of the sky? Chase them. All chucking stones and that.*

Integrity: Vision of Full Skies

As introduced in some of the previous excerpts, participants often adopted a vision of civil drones filling the skies.

- *You'll have to imagine them flying around the sky constantly, because if this is the mass market, that's what there's going to be. We'd come out of here tonight and there would be drones, drones, drones. That's what it would be like, people delivering from one place to another, kids going around watching something as a hobby – they would just be in the sky like traffic, wouldn't they?*

This vision was often seen as an inevitable consequence of opening drones to the market, but was associated with unease and was generally opposed by participants.

- *I'd want to grab it, smash it and stamp on it.*
- *The amount of them flying around everywhere, you know? Surely it would be a nightmare.*
- *I wouldn't want that buzzing around all the time.*

Inevitability: Lack of Agency in Development

Intensive civil drone development was generally considered a realistic vision for the coming years. Indeed, there was a sense of inevitability in this development, with participants expressing a lack of control technological development.

- *To me, the technology is already highly developed and it just seems like the logical next step to where we're going [agreement].*
- *Ten years ago, I remember thinking to myself, 'God, I couldn't imagine someone looking at me while they were on the telephone.' You know, and now with Face Time and everything, it's just the natural thing that we do everyday now. Ten years ago, I think I first heard about it ten years ago and I thought, 'don't be ridiculous; I'd have to have my face on all the time.' Things happen, don't they? They evolve. Who knows?*
- *You'd get to a place where you'd sit in an office or something like this, a load of people, and all of a sudden you'd say, 'we're going to get this package.' 'Oh, we'll send a drone.' It'd just be a normal thing.*

- *It's inevitable... It's just a matter of trying to make it sound as good as you possibly can to the public. It's just another technology that's being sold closer to the inmates [a cynical reference to citizens].*

Substitutions

In discussing the impacts a strong civil drone sector could have on the economy and employment, the participants generally accepted that there would be an impact. Human labour is expected to be substituted by these machines as it happened with other information technologies development over the last decades.

- *I think there would be a movement of labour-type employment. It would shift, as it always does over the years.*
- a. *We're talking about putting people out of jobs but someone's going to have to drive the drones, aren't they?*
- b. *They'll need to maintain it as well. Presumably, someone will bring it down from time to time.*
- c. *Everyone's going to be a drone engineer.*

However, many participants met these impacts with some scepticism. In particular that – even if new skilled jobs are created for design, repair and piloting of civil drones – working class jobs will be cut.

- *Well, it might create 70,000 but again, it might make how many people lose their jobs.*
- *There'll be no jobs left for us because everybody will be taken over by robots.*

The amazon video was particularly evocative in this regard, leading to concern about the distribution of benefits.

- a. *Then it gets rid of people's jobs and everything, doesn't it, you know? [agreement]. That's a delivery driver out of a job.*
- b. *Well, that's what they're trying to do as well, save money.*
- a. *It's only going to be a case of the rich are going to get richer and the poor are going to get nothing, because you put a delivery driver – who will be a normal working-class person – out of a job and then these drones are taking over.*
- c. *Yes, it might benefit you to have a delivery but if you were working in that warehouse and you got told tomorrow, 'we've got a drone to replace you,' how would you feel?*
- *I don't understand how 70,000 jobs can be created when probably double of that will be lost if someone like Amazon get their hands on it.*

Some participants also used a comparison with the Internet to explain why these impacts on employment will balance out.

- a. *I think, like, when the Internet took over the world, that probably stole millions of jobs off people but the world adapted; society adapted and I think, if this did take over, society would adapt again. The Government wouldn't allow a crash where everyone was out of*

work. That would affect the economy negatively and if the point of these is to improve things, wouldn't everything balance?

- b. It's the same with the Internet. Before the Internet, imagine how it changed how people worked, but society just levelled out. The same thing will happen.*

Nonetheless, many participants met the comparisons of civil drones and Internet development (as presented in European Commission, 2014b) with scepticism.

- *I'd perhaps be surprised with what it says here: 'could be compared to the development of the Internet in the 90s'. That's a strong statement because, I mean, that's just been totally world-changing, hasn't it? Now, would drones be world-changing?*
- *I suppose it's difficult to predict how many of these [drones] you're going to make, really. How many of these drones you're going to build, how do you predict that? I mean, is it just maybe for people in the street that are going to buy them; are they going to be like computers are home where there's one per household or whatever? I don't think I'd ever buy one.*

Privacy and Security

Privacy and security have often been offered as clashing human rights for which trade-offs need to be sought. This idea is also visible in some discussions during the focus groups. The idea of civil drone development leading to increased surveillance and intrusions of privacy was often raised, meeting with substantial agreement.

- a. It would be looking at you everywhere you go.*
- b. Oh God, that wouldn't be good.*

Nonetheless, many participants expressed an indifferent resignation to surveillance. This may be because many citizens have long considered CCTV surveillance high in the UK, including this participant:

- *I don't think CCTV is a terrible thing. Like you say, I'm not bothered about CCTV. We've been brought up with that for the last 20/30-years, we've always been watched.*

Several participants referred to the idea that, unless you are guilty of something, you should have no problem with surveillance. In the following quote, this perspective is also linked with expressions of trust in authorities to undertake surveillance in a responsible way.

- *If you've got nothing to hide then-, obviously, if it's someone that's not the police watching you, that's weird, but if it's the police, they're not out to get you if you're not doing anything wrong, so I don't see why not, if you've not got anything to hide.*

Although some were concerned that you may not be able to identify who is controlling the device:

- *If, for example, it was a policeman, you could stop, have a conversation and find out. You wouldn't know why that was following you or what's going on. I guess it's the not knowing that made me feel a bit uncomfortable ... Who's controlling it, what they're controlling it for.*

One of the more interesting aspects of the participants' responses to privacy aspects of civil drones was the idea that heightened surveillance would be acceptable on the condition that they were not reminded of its presence continually.

a. The visibility of it is an issue.

FAC: Do you mean whether you can see it?

a. Yes. If you can see them there it would be a bit disconcerting, rather than if they were there and you can't see them. I think the visibility of a drone-,

FAC: So, you'd prefer not to see it?

a. Yes, because I'd feel like it would be a matter of space; living on a spaceship or in a futuristic film or something, if there were just drones flying around.

In this sense, participants were more concerned about the feeling of having their personal space intruded than they were about excessive surveillance or privacy intrusion, which they accepted as an inevitable fact of life.

a. They'd have to be silent.

b. Yes, they would have to be silent.

FAC: Is it better if they're silent?

b. Yes. Well, if they're going to intrude on your privacy that much, they need to be quiet because I can't deal with that.

One participant light heartedly suggested that personal drones could be used to monitor children:

- I think would be good, you know, life if-, because I've got a little girl. If she went playing out and I didn't think she was where she was, I could follow her. She wouldn't know I was there, but I'd be there watching her. That would be quite a good idea. She'd be like, 'oh no, I've been here,' and I'll be like, 'no, you haven't.' (Laughter) ... A small one like that, so she wouldn't know I was watching her.*

The participants also discussed some approaches to protecting privacy by limiting access to video, either by restricting it to authorised personnel, or by using video only as a live stream for navigation, without recording it.

a. Will they record it or just literally use a camera to find their way, without storing the data anywhere?

b. That's a good idea, yes, it's not recording it. It's just a live stream.

c. It's like when they brought in the full body scanners at the airports and there was a big kick-off about that, but they had specially selected people, a small team out of all the security people, who were actually allowed to look at the X-rays. So, you've got to be licensed or registered to be able to ... I wouldn't let it open up to the general public, whose just having a little watch of this.

- There could be restrictions on who can see the footage, so it's not just, say, if you work at Dominos, you can jump on there and look at all the footage from these drones, that it's actually policed, so to speak.*

Dual Use

Participants were generally supportive of the use of drones in military contexts and did not raise any criticisms of the relationship between the military and civil drone sectors.

- a. *I think it's a great idea for the military, because then our troops can go in without sending bodies in. They can send them in to have a look at what's going on.*
- b. *Yes, you don't have any negative connotations with the military because they're there to protect you.*
- *I think we all agree that for stuff like that, it sounds good, do you know what I mean?*
- *I think it's development, good development, good use of technology in the military.*

The main point of concern was that enemies could also use drones.

- a. *There's nothing negative you can say about that, nothing at all.*
- b. *Unless the other side get it.*
- a. *Yes, that's true, yes.*

One participant was concerned about the future developments in the international landscape. Again, the critique is not against the military drones per se, but about their potential use by enemies.

- *Is it a benefit to develop a military drone sector? I really don't think it is. If the drones keep going and developing and developing and developing, Israel, for example, what if they turn on us in the future? We don't know what's going to happen in the future. If we're actively increasing the capability of drones that can cause mass destruction and death, surely that's not-, well, it's a positive if you're fighting a war that you want to win, but if someone turns on us-, what if America turns on us in the future? You don't know what the future is going to entail and if we're just pumping money into drones-*

Here, one participant argued that, as well as military drones potentially being used by enemies, the use by allies could also lead to the escalation of conflicts.

- *Yes but if our military are using them, any enemies are doing exactly the same thing. The drone strikes stuff, especially with America, there's a lot of targets that they're aiming for and a lot of the time, it doesn't hit the target and it hits the school or whatever, and that's where a lot of the negativity comes from.*

Several participants were concerned about the potential use of civil drones by terrorists. The proliferation of civil drones in society was frequently identified as introducing a vulnerability to terrorism, because if small devices were normalised, it would be relatively easy to use them for bombs.

- a. *I don't want to be dead morbid but I was thinking, on the Amazon advert, what if that was a bomb though, and someone just dropped a bomb? Like in the city centre, if they got legalised so they could go anywhere.*

- b. *Yes, you wouldn't think it was weird if you saw one, so you might just-*
- a. *No, 'they're just coming to drop off a package.' Sorry, I know that's dead morbid.*
- *I think it would be quite a bit threat to security with terrorism and things like that, the way it is at the moment, that it can carry objects like that. What's to say it can't carry an explosive or something like that and drop it into a really busy area, undetected. No one would see it coming, would they, really?*
- *The more drones that are in the sky, if they did want to attack us, we wouldn't know it was coming because we'd just think it was an Amazon one coming over, another one.*

Overall, the use of drones by the military was supported, with the key problem identified in the potential use by enemy forces. Certainly, military use was more strongly supported than hobbyist or recreational use, as discussed in a subsequent section.

I think if it's used by the military, it's contained, isn't it? It's when it just becomes used by everybody.

Responsibility

Participants often suggested that each drone should be registered, as is the case with cars. Registration and insurance were also seen as effective means of enforcing the liabilities of pilots.

- *Surely, if there are so many in the sky, you'll have to have registrations on them? If it crashes into something or something, how would you know whose it was? You'd just think, 'okay, it's crashed,' and you'd put the remote down and run off.*
- a. *You'd have to get insurance on it.*
- b. *What would happen if you didn't have insurance on it? ... Are they going to do checks on people to make sure they've got insurance for it?*
- *Yes, it should all be traceable back, shouldn't it, to whoever owns it?*

Here, a participant argued that where minors use drones, there should still be a traceable acceptance of responsibility.

- *No but if you bought, let's say, the kits, the 'build your own' kit, there should be something that you have to sign before you-, like, even if it's just an e-agreement on the computer or something, and you've signed your name to that, you know, 'I agree to use it properly and not fly it over playgrounds' or whatever and then you get it delivered to you, no matter how you purchase it, as long as you've then signed an agreement.*

3.3.2 Trust: defining the Boundaries of Acceptability

Support for civil drones amongst participants depended largely upon the specifics of the application they are used for. Users often distinguished between those users or uses that were considered acceptable and those that were not.

- *You wouldn't have your granny using them, would you?*

- *I think it's disgusting. That you can just buy them. They shouldn't be just available to the public.*

The following excerpt captures the sentiment of most participants, who felt trust in the established institutions to use them, but felt that personal use was frivolous and unnecessary and, therefore, should not be allowed.

- *I think the police force would be acceptable; I think the military is acceptable ... I just feel for personal use that is not acceptable ... you don't need it, do you?*

Opposition to Public Availability for Hobbies and Recreational Use

The strongest opposition was directed towards public use without clearly defined and socially beneficial objectives. This did not include recreational or hobby use.

- *Just the hobby one stands out the most ... All the rest seem to have a purpose.*
- *I can totally understand it in industry; I just don't get it in a pleasure/personal kind of way. The Internet and the iPad, we all have one. We all use the Internet everyday and I don't get how that drone thing.*
- *It's just the fun bit I don't get. I don't understand why you'd want one for fun.*

Approval of Police and Military Applications

Participants strongly supported the use of drones by military, police and other authorities such as border patrol and emergency response.

- Yes. I think it would be safer in Afghanistan or somewhere like that. You can send them out, check it's safe and then send the troops out there, and you can see what's going on before you actually send the troops in. The police as well, if they're doing a raid or whatever, they can see if it's safe and then the police can follow on.*
- Well, I think wherever it can save life and, you know, prevent death, then, basically I think it's a great thing. I mean, spying I'm not sure on, but anything certainly on saving life I think is great.*
- Even if it's not saving a life. If it's property or something of value.*

Generally, this differentiation between trusted and non-trusted users was a matter of control and regulation, as captured in the following excerpt.

- *I don't have an issue with regulated bodies using them, like police, councils and stuff like that, I have no issue with that whatsoever. The issue I have is, sort of, the unregulated, private use, is why I have issues. Companies, people at home buying them and using them for things. Police, councils, stuff like that will be regulated – probably by the EU and stuff like that – by international laws. I don't have an issue with it at all.*

Hence, in general institutional uses are acceptable, whereas those uses that cannot be scrutinised cannot be trusted either. But some participants were suspicious of police use. This is revisited in a latter section on *function creep*.

- *I just think they'll get misused, even by the police, because half of them are all bent anyway.*

Opposition to Flippant Applications

Across the focus groups, participants repeatedly drew a distinction between applications with defined and serious purposes, and those that could be described as flippant, without a clear benefit that extends beyond the pleasure of the user.

- *They seem better for commercial use. Like you said, the kids using them and Amazon, but when it comes to police, search and rescue and military purposes, like Intel gathering, I think that's the benefit for it. I think that's where it should stay, personally. Kids using drones and Amazon, just blows my head off.*
- *I think it really all just comes down to what it is being used for. I think, 'who is this being used by? And then, 'what is it being used for?' If it is being used by the police then as long as it's not monitoring every single house in the street, if there's one specific place that needs to be watched and if it's military, again, instead of sending people in, like the remote bomb detonators that have been around for a long time, something like that, to help people. If it's just, like you said, somebody's just got it and they're using it for whatever they want, like it says on the other side 'hobbies', that is probably the only one there that really worries me.*
- *It's a good idea when you're say anything like drastic disasters, like when China had floods or tsunamis and you get places like Arizona that have huge, huge bushfires, and Australia and things, so it would work for that and it would be a very good idea for things like that.*
- *I don't like the sound of them at all. I don't mind them for things like disasters or floods or for checking pipes out, but just to have them for stuff to be delivered or watching you, like you say, it's your privacy being taken away.*
- *I don't think it should be available for the public to just buy them. [agreement]*
- *I'm not that keen on it at all. I think it's good for military and good for what's needed, like the oil rigs, but not for general use.*

Function Creep

Some participants expressed concern that drones may be introduced on the basis of applications with far reaching social benefits, before being extended beyond this mandate, for applications not originally envisaged. Usually, this was expressed in terms of the number of drones that would be used.

- *There might have been 100 websites at first, the big companies, now everyone's got a website. Do you regulate how many there are? Who can apply for one? They would just be whizzing around all day.*

This function creep was also expressed in terms of the range of purposes for which drones may be used, particularly in extending police powers.

- *Once the police get them then obviously they're going to use them for everything they possibly want to use them for, and as the first stages come in and you let them use them, within two or three years, they'll then be using them for close-up viewing and closer looking and you'll then have all the experts that have got the techniques to do this with them and do that with them. It's just like everything that's provided to us, they show the end of the stick here, which is to say how great they are, but then you always here new stories like, you know, with the cameras in the street. They're spying on people who are putting rubbish in the wrong bins and then suing them for it or whatever. To me, it's great and people should know when they're used for good things; I mean, if you're going to use them for this, that and the other, that's great, but once the police get them [...] once the police get them, it's then being used for one main purpose, which is to control the masses.*

In the following excerpt, a participant accused the moderator of trying to achieve acceptance for the technology on the basis of social benefits, before it will be rolled out beyond this mandate.

- *I just think that what they're trying to do is use something that's used occasionally, all the time. You're trying to find a way to sell this or research it and put policies forward that the public will accept. The problem is that, once they do accept it, routine patrols is where it's at, so privacy is-, you're going to have loads looking through ladies windows. I mean, it could be-, it just seems to me, it's ridiculous the amount of cameras we have and now to do this is laughable. I just think it's a joke.*

At one point, a participant referred to the possibility of remotely piloted passenger aeroplanes.

- If they can send up a drone the size of a plane on its own, how long will it be before they start sending it [passanger planes] up on its own? Without pilots, because they can do it from the ground. It's like, where sensibly do you draw the line?*
- Yes, sometimes with these things they say all the good things that they could be used for, and it strikes you sometimes as a bit of a smokescreen.*

3.3.3 Reflections and Recommendations

The final part of each focus group session was devoted to reflections. Organised into small groups, participants discussed together before making overarching remarks about civil drone development, and identifying which ethical questions are most important to them.

Controlled usage: Opposition to Public Availability

- I'm not stuck on them. To use them with military and everything else, great. Not for your normal walking around the street, I'm not interested.*
- Not for me. I don't think normal everyday people should use them.*
- Companies, it depends what they are. Police, yes, that's fine, it's protecting you, but other than that, no.*

- *Don't let in just the general public.*
- *That's the problem you've got using it in the public. You could get a guy to develop to use a gun on one. Who knows what they could do with it but the next thing, there would be people getting murdered. Drone murders, you could be killed by drone. How are you going to police that? A police drone?*

Excitement about Potential Benefits

- a. *I know everyone disagrees, but I'm excited to see how they will benefit society.*
 - b. *Yes, it's going to be interesting. Just the last one with the sport [filming sport events], I was thinking, 'yes, that would be really good.' It will happen, so I'll just embrace it.*
 - c. *I think they'll be good for crime prevention and stuff like that.*
- a. *Yes, I think it's pretty intriguing really, the benefits that it could have in a personal and a commercial aspect*
 - *I think we're going to see them. I can see the advantages of them. I can see how, like a home security system, a drone could be used for a home security system. I know we were laughing before but I could see it helping somebody who is visually impaired. I can see it doing these things and I think it's just getting used to seeing something different. I think we'll get used to it.*
 - *I love it. They can deliver your breakfast.*

Concern about Privacy Intrusion

- a. *How intrusive it is and all the other risks makes it pretty dangerous as well, I'd say.*
 - b. *I think I'd just get on with it, as long as it doesn't wake me up after a night shift.*
- *How can you safeguard against people's privacy?*
 - *How, with the introduction of civil drones, will personal privacy be upheld.*

Need for Strong Regulation (Licensing, Registration, Restrictions)

The need for regulations on the use of civil drones was particularly strong, with the 'reflections session' from each group dominated by concerns about effective licensing and registration rules to restrict use to trusted actors in specific circumstances.

- a. *How can they guarantee the wrong people aren't going to get hold of these things? How can you keep it-, We said maybe there could be age limits on them, like you'd have a driving licence. You've got to be 17, you've got to have a licence. You've got to be registered.*
 - b. *They should check, say for example, if you've got a criminal record. If you've got any previous convictions.*
- *If it's commercial in that sense, as in commercial to deliverers and not surveillance kind of thing-, How would you know? It would have*

to be clearly marked and regulated by a body. You'd have to get permits and whatever and it would have to say Amazon in massive letters. I mean, you could forge it and whatever, but Amazon would be liable. It would have to just become a highly regulated body, I would think. I think it could work.

- *I'm intrigued as well to see how it's going to be policed and regulated, and how it will affect our normal everyday lives, really.*
- *How's it going to be regulated, who can have them?*
- *Just what would be the main uses for it and who will be using them?*
- *How will the development of civil drones be moderated and controlled.*
- *What regulations are going to be put in place? Will you need to be insured and will you need a permit? How's it going to be monitored?*
- *What accident policies would there be to put in place, insurance etc.? For example, if you're driving and one falls on your windscreen because it's run out of life or whatever, you know, what would happen?*
- *How can they be moderated? Who's going to be in charge of it? Who's going to be responsible when it goes wrong?*
- a. *How do you know if people have got them or built them without a licence?*
- b. *What safeguards will be put in place regarding airspace and the protection of people on the ground.*
- *Will the general public need a permit to fly a drone? Are the flights tracked and can people have an agreement to sign when they purchase them?*
- a. *I think it should be controlled. I don't think it should just suddenly become a great big mass where, just because you want it, you can have it.*
- b. *The Internet wasn't controlled, was it?*
- a. *Well, maybe it should have been.*

Distrust

Several users expressed concern that civil drone development would start with socially beneficial applications, but the boundaries would extend beyond the original mandate leading to problems. These include reference to the 'full skies' vision described earlier, as well as opportunities for misuse and the invasion of privacy

- *How can we be sure that they're not going to change the rules and regulations once it's up and running? Like, to start off, it's quite tight, the rules, and then it becomes lax.*
- *How would you regulate the police using them? Is this a thin edge of the wedge? Is it going to be developed into something further than that? Is the point making a lot of flying people, beginning with this?*

Beginning with a camera, but that's it's really just a very insignificant part of the whole development of drones.

3.4 Discussion

The insights from the focus groups raise several interesting points of relevance to current initiatives from various actors involved in civil drone development in Europe. These are considered in more detail in the following subsections.

3.4.1 Surveillance and Privacy

Many participants felt that intensive surveillance, particularly by video camera and online tracking, was an inevitable fact of modern life. While some felt uncomfortable with it as an intrusion of privacy, these feelings were often balanced against the increased security offered, for example through police access to CCTV footage. A curious insight from the focus groups was that participants preferred remain unaware that they are under surveillance, feeling like reminders of on-going surveillance would be more distracting or invasive than the privacy intrusion itself. This is particularly interesting in the context of debates about how to respond to privacy concerns with civil drone development. For example, a recent report on privacy and data protection aspects of civil drone development highlighted the contrast between traditional aircraft – which are general noisy and visible, as well as rare and relatively traceable – with small RPAS which may, in effect, be silent, invisible, untraceable and relatively common (Finn *et al.* 2014). While the potentially unobtrusive pervasiveness of small RPAS may increase the risk of breaches of citizens' legal rights to privacy and data protection, it seems that increasing awareness of such surveillance may increase the risk of intruding upon citizens' experience of privacy and personal space. This interesting contrast can and should be explored in detail in considering options for responding to privacy concerns.

During the sessions, some solutions to privacy concerns were also suggested by participants. These included restrictions on the ability to record video streams, so they can be used for navigation purposes but not for storing video footage for later viewing. A second suggestion was to ensure that only authorised and properly licenced and registered users could access footage from drones. This tied in with a broader suggestion that the operation of drones should be limited to specific users for specific applications. As we shall see, this would include applications with clear social benefits, but exclude personal recreational use as well as 'frivolous' commercial uses. While police and security services were considered (largely) trustworthy, other citizens' use of drones was viewed with suspicion.

3.4.2 Substitutions

Scepticism about the recipients of economic benefits, including job creation, was clearly expressed during the focus groups. While many accepted that the development of a civil drone sector would create jobs for operators as well as manufacturers and repair work, they expected job losses elsewhere, particularly in the traditionally working-class sectors such as factories and delivery. Comparisons with Internet technologies were often used to justify this expected inequality in the distribution of benefits.

3.4.3 Integrity: Killing Machines or Full Skies?

We found little evidence in support of the assumption that citizens currently hold a killing machine vision of drones due to their representation in cinema and actual military use. While cinema and television were frequently raised (unprompted) by participants to make sense of the technology, their early impressions appeared to be more strongly shaped by incidents or experiences with civil drones. Where military use was raised, it was seldom representative in terms that could be considered negative for civil drones. However, negative first impressions were expressed with reference to surveillance and nuisance.

Indeed, through the sessions, the vision of drones as killing machines was rarely demonstrated, even when discussing drones in a military context. The key problem with military use of drones, as identified by participants, was the potential that enemies, including current allies that may become enemies in future, could also use them to launch effective attacks. Indeed the idea that associations with military drones could foster public opposition to civil drone development was roundly countered in the focus groups, with support for military drones notably higher than support for publically available drones and personal or recreational applications. This finding runs contrary to the assumptions presented in the ESGR roadmap and was surprising to the facilitator.

A much more widely adopted vision of civil drone development was one of ‘full skies’, where civil drone use grows to the point where they are a near constant presence in our lives. In this vision, the force of numbers necessitates the establishment of sky lanes and rules corresponding to those currently imposed on car drivers. Drones would be used for several applications, including delivery services, and interactions and encounters with them would be common. While this vision was occasionally met with excitement about their potential benefits, it was more usually expressed in negative terms, with concerns about collisions and power failures leading to accidents and potential vulnerability to deliberate criminality and malice, including terrorism. The invasion of personal space and creation of noise pollution were also cited as problems with the development of civil drones as seen through this lens.

This ‘full skies’ vision is related to participants more concrete concerns about function creep, whereby drones would be introduced for specific and exceptional purposes (such as emergency response or filming sporting events) but would gradually develop until they are used for many everyday mundane tasks (such as delivery services and routine police patrols). This idea is encouraged by comparisons with vastly successful and well proliferated technologies such as the Internet and iPod (e.g. in European Commission, 2012, 2014b). However, while the economic and employment benefits touted through these comparisons were met with some scepticism, the potential growth in daily use, supporting the ‘full skies’ vision of drones, was widely accepted. The idea of function creep was also fuelled by participants’ feeling that they do not have control over technology development.

Hence, the relevant ethical issue here is integrity, the imagined bodily experience of the ‘full skies’ vision.

3.4.4 Beneficence & Malice: Acceptable and Unacceptable Development

Overall, the participants trust the potential use of drones by authorities, particularly the military, police and emergency services. While some participants made isolated references to police corruption and doubts about military drone use, these were not accepted by the groups as a whole. The response to commercial applications was mixed, with acceptability generally conditional upon a serious social benefit (generally limited to creating a safer and more secure society) and sound regulation to counteract deliberate and accidental misuse

(such as licencing of pilots, registration of devices and liability for operators). Public and recreational use was widely criticised, in particular the wide availability of armature devices through mainstream retailers.

Concerns about function creep were often raised along with expressions of inevitability and lack of public agency in development. Participants did not feel that they had any control over how the technology would develop. They adopted a position of resigned acceptance or submission, expressed in comparisons of citizens with hospital or prison inmates, and references to society's capacity to adapt and deal with new nuisances. Occasionally, this inevitability of development was expressed in a more positive form, as participants referred to other technologies, such as smartphones, that were rapidly integrated into their daily activities without substantial difficulties.

The participants did not support developments in civil drones that could lead to vulnerability or to misuse. Examples of misuse varied, covering a wide spectrum of malice from children accidentally causing accidents during innocent play, to thieves and perverts using drones to support deliberate criminal activities, to terrorist attacks executed with drones disguised as serving civil purposes. Such vulnerabilities appeared to be a greater problem to the participants than privacy intrusion or any associations with military applications.

In response to these divisions of acceptable and unacceptable applications of civil drones, the participants considered regulation akin to those that apply to driving, with operators required to hold licences, individually identifiable devices registered to individuals, minimum requirements for insurance, and civil and criminal liability for the consequences of any misuse. Furthermore, participants often argued that permits for operations should only be granted in specific circumstances to responsible actors. For example, police and emergency services may be granted permission to operate a drone in a set of specified circumstances, and not in others, while commercial use may be permitted where a serious social benefit is identified. Often, they argued that citizens should not be granted permission to fly for recreational purposes, and, that they should not be able to acquire and operate them freely.

4 Wearable Sensors

4.1 On Wearable Sensors

Wearable sensors are portable devices that collect specific data about the body, for example blood glucose levels, heart rate or movement. For fitness and health purposes Whilst some wearable sensors can be used by healthcare practitioners to monitor and treat people with a medical condition, other wearable sensors, such as “fitbit”²³, is a device for everybody that claims to increase physical activity in order to lose weight; it is sold with a compelling narrative of fitness (a fitness formula) that can be resumed as follows: eat less, walk more, sleep well and don’t forget to drink 2 litres a day – see Box 4.1. Wearable sensors are increasingly used in bottom-up or Do It Yourself initiatives where citizens produce knowledge about their bodies by collecting, interpreting and sharing data²⁴. These forms of citizens-led or peer-production of knowledge are creating new directions for public engagement toward what is called citizen medicine, “do it yourself” or grassroots medicine. In this context, it is vital to discuss look into issues of quality, responsibility, reliability and impact of citizen’s inputs to complement, and in some cases, change or redirect predominant practices.

Box 4.1. Wearable sensor: fitbit

“fitbit” features sleep monitoring (the tracking of movement during the sleep) and the possibility to compare calorie consumption and calories burned. The user is asked to wear the device 24/7, register food consumption and activities other than walking, as well as mood swings through the associated online platform. As a result the user can see charts with information on daily activity, resting, eating and compare the data over a time span and see how “fit” he or she is compared to other users. The “fitbit” company suggests every user to eat a specific amount of calories and to walk 10.000 steps a day in order to reach one’s personal goal of weight loss. The fitness formula can be described as: eat less, walk more, sleep well and don’t forget to drink 2 litres a day.

The importance of biosensors (sensors that monitor biologic functions) is primarily seen in the area of healthcare monitoring, although it is more used for fitness, sport and self-monitoring. Besides the academia, healthcare and industry, policy makers are also looking into wearable devices as means to increase efficiency and quality of healthcare. Although there are no specific documents looking at and discussing the wearable sensors, policy developments in the field of telemedicine and ICT for healthcare have been present in Digital Agenda for Europe, the European Innovation Partnership on Active and Healthy Ageing and Horizon 2020. For example, the European Commission’s Communication C (2012) 4536 of 9 July 2012, under Cooperation: Theme 3: ICT- Information and Communication Technologies mentions ICT for Health, Ageing Well, Inclusion and Governance as one of its challenges. The main goal is to empower citizens “to improve and manage personal life as a citizen, elderly, patient, consumer, civil servant or worker” (p.53).

Similarly, it is important to mention that the European Commission also launched several calls for proposals for projects related to biosensors, mostly in the area of telemedicine, e-health and active ageing.

²³ See Fitbit.com

²⁴ See for example, the quantified self movement.

4.2 “Ethics Dialogues” – methodology

Similarly to the case of Drones, we have implemented “Ethics Dialogues” about wearable sensors through “focus groups”. A pilot focus group was conducted at the JRC in order to test the methodology and the materials used to introduce the subject and elicit discussion. Four focus groups of between 10 and 12 participants were conducted in Milan (Italy) and Croatia. For the recruitment of the participants, venue, recording and transcription of the sessions, we used one company in Croatia and another one in Italy. The criteria used were based on a balance of gender, age, and experience and no experience with wearable sensors or fitness/health apps. The companies were also in charge of providing the informed consent to the participants and dealing with their data according to national legislations.

The final design consisted of two stages. On the first stage we have experimented with “material deliberation” (Davies et al. 2013), distributing to the participants different types of sensors asking them to write down what came to mind about these objects for them or for the world, including not only the objects but also the narratives with which they are advertised. A brief discussion followed. Audio-visual material was subsequently showed, either advertisement of some wearable sensors or apps, short quotes from the media (mostly online newspapers) about the possibilities offered by wearable sensors and apps. During the discussion, participants shared their beliefs, attitudes and values in connection to wearable sensors. In the second stage, we showed them the quotes from the Green paper on mHealth that was published in April 2014 by the European Commission. The idea was to explore their views on the heralded benefits of mHealth (to which wearable sensors are an integral part), e.g. whether wearable sensors can deliver a higher quality healthcare system; impacts for patient doctors relationship; divides an inequalities for healthcare, and so on, including their thoughts about current narratives of technological innovation and society.

4.3 Dialogues on Ethics - Wearable Sensors

4.3.1 Materiality, Integrity and Invisibility

The sessions started with participants examining, experiencing and trying different types of wearable sensors, including not only the object but also the package and the instructions. They were asked to write down their first impressions or what comes to their mind when they experience them. For the participants a very important topic was the design of sensors²⁵. Besides being practical and serving the cause, it is important for a sensor to “look nice”.

A: This bracelet, I like it a lot because it is simple, although I don't know what it is used for... I didn't write down that I don't know what it is used for, but it is too simple, you can wear it also as jewellery.

B: Indeed, I like its design and it's very light and simple, different from all the others. They are all too big, I don't even know where to put them, on my arm or on my leg, I don't like the t-shirt with all these tentacles, it's just too big. The bracelet is very simplistic.

C: It is. The best we have seen here!

²⁵ This might partially explained because in some of the groups the affiliation of the moderators was somehow not taken into consideration, as many participants thought that the moderators were from companies testing out models.

D: The belt is practical for wearing. As far as I got it, it is connected to heartbeats and I think it helps with relieving the pain.

A: It seems unpractical...

D: It's magnetic if I'm not wrong. It's about energy or something.

B: It really seems unpractical. But the bracelet is great!

E: Yes, it's the best of everything and this is by far the worst because of all these tentacles...

Although many agree that the design is important:

- *If you need to wear it all the time, it needs to be handy and light.*

Others think that there are things that are more important:

- *According to me, the design is not the first thing to take into account.*

While discussing the usefulness against the design, one participant succeeded to persuade another one to change his opinion about a sensor that is, according to the first one, very useful:

F: On the other hand, I think that this t-shirt is a culmination of this kind of equipment exactly because it has all those extras that measure all the currents, pressure, and heart beat meter. So, when you make an effort, this and that, when you keep a track or an application does it for you, what is the inclination, steps and so on, you see exactly how your body behaves in a given moment.

A: The question is whether this is made for professionals or amateurs.

F: For those who need to use it.

B: Someone will use all of these.

F: The T-shirt reads every muscle.

E: If it does, then it's great. I'd certainly wear it!

Many doesn't want it to be visible especially if it is worn for medical purposes

- *Wearing it [a sensor] is not that comfortable, especially when you are sleeping. But let's say when it would be something like that T-shirt that can not be seen, it would be totally ok. No one would even notice. When I was wearing the Holter monitor, for example, I didn't go out. Because it was visible under my shirt. So, I was mostly at home. In addition, they brushed him with that gasoline and stinks like hell.*

Although not perceiving them as the best solution, participants in our focus groups agreed that the sensors will be our future. For many participants, wearable sensors represent a technology of future and something that will be used for medical purposes in the future.

- *Everyone will stay in their houses and won't move. They will have their own sensors.*
- *Everything will be on button.*
- *According to me it is good, technology of the future, but only in medical purposes. For me personally, absolutely useless.*
- *There are still many devices to be made.*

- *I have thought about the future, I think this is something that is already there, but it is not very precise, there is still a lot of work and research to be done but it will surely be essential for the future, but maybe not for all.*

Participants stressed that wearable sensors can be useful for sport, fitness and wellbeing: and :

- *It is a good thing to improve the exercise and progress in sports, but more for professionals than for us, the amateurs.*
- *I think it is used for monitoring body functions during sport.*
- *I have written health, progress and form.*
- *Sport activities, health and monitoring success.*
- *Regulation of weight and encouraging sweating.*

The benefits of wearable sensors for elderly people were also introduced:

- *For instance, with unhealthy people or even more elderly people, just where I work, I am sure they will not become obsessed with it. If they had problems with [blood] pressure, they could exactly see what affects it and what to avoid, what kind of efforts. Maybe it is on psychological basis. Some people have high pressure due to sleep and a sensor such as this one is a true indicator of it. I think we are all our own best indicators, but it would be very interesting to look. Maybe it's something we do not know. I'm not against the progress of technology, but exceeding in everything can, of course, be harmful. Anyway, if we become obsessed with the technology, I believe we will end up being chipped.*

At the same time, some participants see different constraints, thinking that people could become obsessed:

- *I have looked, through the example of blood pressure monitors, how both my younger and older neighbours are obsessed with measuring the pressure. For me it is a surplus, something that turns me into a slave of numerics. For instance, when I'm on the bike, I don't want to lose time measuring pressure and thinking about it. The same when I want to drink coffee or do this or that. At least 10 of 15 of my neighbours are mentally obsessed with the blood pressure monitor. I wanted to destroy my mum's.*

or that sensors will create more panic:

- *If I'm at a hospital and they do me an ECG, there is an MD besides me. If I do it alone, while on trekking in Nepal and it starts ringing, I will start panicking, so it might be better to leave it at home.*

4.3.2 Ethical issues

Data protection and privacy

For many, data protection and privacy are large issues that still need to be discussed. The participants in our focus groups looked at this from several different perspectives. They started with contemplating about sharing their data online in general, while surfing on the Internet, wearing smart watches 24h a day and so on and finished by expressing worries about their health data being seen by others and not only their doctors and all possible abuses

- *I do not know about the price, and it bothers me more that it should be linked to a mobile phone whose data are in the Cloud. Consequently, all my data about where I*

go, how much etc. all of it would be available on line as well as possible to be downloaded.

However, there were participants who do not care about privacy because they think that all our data are already public. They are also not concerned because they think the chance is small that someone will be interested in their own data.

A: I have no problem sharing my own data, I stand behind it ...

B: Each application has some kind of protection. As Facebook and all these leaders, I think every dot is protected. Images can be locked, protected, but there are people who hack. Okay, if that's your job, hack, but most pages are somehow protected in some way.

C: I believe the data are protected.

A: I am sure they are not protected.

MOD: And you don't have any problem with it?

A: I have no problem.

D: There are 7 billion of us on Earth, when will they reach us? We are a small country.

A: We are so small but I am also sure that everyone can see my data and everything I publish, but it doesn't mean anything to me if someone is watching...

MOD: So, you think that the data is actually available to anyone who really wants to see them?

A: That's it.

D: But it doesn't, more or less, interest anyone.

A: It doesn't because everyone puts everything public nowadays.

Many participants have stated that the best place to put sensors is under the bed because, as long as they are not visible and intruding, they are fine with it.

A: Yes, I would put it under bed.

MOD: It wouldn't bother you?

A: Not at all, because I wouldn't see it or hear it.

B: And we would have a better quality of sleep. That's what I read.

C: And what about radiation?

But, some were concerned about who will use and interpret their data connected to sleep patterns and being in the bed.

- Yes, I would, under the bed. The only issue is where this data will be used. If these data are only for myself, if that day I did this and that, went to bed at a precise hour, woke up, turned around and so on, then I can see what to do during the day if I want to have a quality night's sleep. Well, to improve some things why not, for me personally. But again, it all depends where the data will be seen.

Another issue closely connected to the privacy is being online for 24 hours, which has been suggested by wearing smart watches.

- I wouldn't like to be on the Internet for 24 hours either.*
- The technology advances, but this seems like an invasion of privacy. Wearing the sensor now and then is ok, but being 24 hours online is like being in Start Trek, for*

me it's the invasion of privacy, I want to be able to turn off when I want. If I go out, I don't want any technology with me, anything, even if the technology wants to be with me 24/24.

When thinking of sensors and apps used in healthcare and the health data being in the Cloud, the majority of participants expressed their worries.

A: I don't like any of my data go to the Internet...

B: What it comes to health, you're right. I think it's something between my doctor and me.

MOD: Are you bothered by the availability of your data online or the possibility for their manipulation?

A: That's right. They mentioned Facebook, I limit myself by not putting pictures, or what I'm not interested in, so my data are not there and I know what I put online, but to let someone put my medical data, well, I don't agree with it. It's the invasion of my privacy, regardless of what it is precisely and it is my intimacy.

B: Yes, it's too much interference in our private lives.

C: When companies employ people, they could get information about the diseases you have even though that disease has nothing to do with this job. The companies could control people in that way...

D: You cannot work because you have high blood sugar or back pain.

A: And no one gives you a job because of that!

B: The best would be if the data went straight to the doctor!

These worries are further thought of in the frame of insurance companies or employers that could see in that way who suffers from what disease.

A: This is not good. It means that your insurance company or your employer has absolutely all the data. That is priceless. It is an invasion of a basic human right, the right to privacy.

B: In fact, you're off.

C: Like being chipped!

B: Chipped indeed!

A: You walk through the door and they know all about you.

B: Can I ask you something, has this product been made with the purpose to help us or to assist insurance companies and some other similar bodies?

C: Now that I've seen all of this, I think that they might have financed all of this. If the information about me go to the insurance company...

A: All of this comes to the same. If it is in the right hands it can be good. But everything can be misused and so can that.

But it is very worrying that people agree that nothing is protected anymore.

- *From now on, there is nothing safe and protected in our lives.*

Self-veillance, sous-veillance and surveillance

In the eyes of many focus group participants, the use of wearable sensors is useful to learn something more about us and to be able to *control* ourselves.

- *I like having the knowledge about my physical condition etc.*
- *Control.*
- *I like to know, even if it's not for myself. I don't like to live in ignorance.*
- *I would like to use it in order to control myself.*

Hence, the possibility of self-control, self-tracking or self-surveillance was amply discussed:

- *I would buy it to control my lifestyle and correct it if needed.*
- *I would buy it to check my lifestyle, if there is something that scares me, I would go to the hospital and wear Holter.*

A: I think it's a great thing that people can follow their own (medical) condition, some people have certain health problems and they should know what they must not overdo. For instance with high blood pressure or high or low blood sugar. If you have excess fat, it's good to know how many calories you have consumed.

B: And consequently you can react on time.

MOD: would you buy something similar?

A, B: No.

MOD: Why?

A: No need.

B: No need to constantly measure something.

But there were other forms of *veillance* that emerge during the discussions. The following quotes illustrate those:

A: The possibility to control babies during the night is great.

B: Babies yes. Older children, no. We cannot control them 24h. No one controlled us when we were kids and we played, went out, fell, and were hurt. If I need to monitor him every time where he went, if he doesn't want to listen, the monitoring won't help, he'll go there anyway.

C: I can't be a God watching over her. I can have certain control as a father but that's too much.

B: You should create trust, not a slave.

A: When we were young, we lived without any control. That's the point. Otherwise, the man becomes just a simple object.

B, C: A robot.

D: That is always under control.

- *The goal of mobile health is control and surveillance.*
- *They want to control us. We have been already surveyed with all these devices. The technology is an invasion.*
- *The technology gives you certain privileges while taking away others. It makes you do things more quickly but it also conditions you.*

A: You are monitored wherever you go.

B: A woman who becomes a machine, I saw a movie on it quite recently at the cinema.

Another issue that participants stressed is the accuracy of sensors and how much we can trust the data they produce and show:

- *I'm not 100% sure in their accuracy, for instance, there is an app that measures your heart rate by putting a finger on the camera. I mean, it is possible that it is exact but I doubt. When several people tried, they all got the same results.*
- *It depends on what you are measuring!*
- *The accuracy of sensors is often questionable.*
- *I trust some, but not all of them.*
- *I have at home blood pressure monitor because I have problems with it. I need to measure it every day because it varies a lot. But I always measure twice. Once it shows 120/80 and the other time 130/75. That's how accurate it is!*
- *Nothing can be 100% precise, it has to have an error, the question is only how big the error is.*

Trust

People are also concerned with trust, seen as either trust in new technologies or in companies that produce them.

- *I do not trust!*
- *I think they are useful, but not 100% effective. We must use them sparingly and in a critical way, so that we do not rely completely on them*
- *I would consult my doctor before buying them and trust him more because he knows me well and he knows my health problems so he can advise if the sensors can really help*
- *If I had cardiac problems I would go to the hospital and not trust these devices.*

The difference between trust in a medical personal or a device will be also discussed later around the topics of mobile health. Some participants were concerned by the potential harmful effects of using constantly different sensors:

- *I am a bit worried, I have no idea how much radiation I could get from wearing them all the time. I would not purchase it.*
- *It has some sort of radiation. I would never put it on babies and children.*
- *I would give it to my child only if he had some health problems.*

Inevitability

Participants were also discussing how useful sensors are and why they are presented to us as indispensable or inevitable:

- *They are imposed to us for business, I don't have that exigency!*
- *For me, this is too much. In the end, the machines will use us.*
- *We will be the guinea pigs and then they will tell us that they are making it for us and that they are useful. But we don't know it.*
- *One should take and buy things that are useful.*

Normalisations

As pointed out before these types of gadgets come with a narrative. The fitness and wellbeing wearable sensors companies' websites, it is often claimed that sensors can influence our motivation to exercise. Some of them like, 'fitbit', are presented as companions with which one can establish humane relationships, using welcome, encouraging or even more intimate user-set messages for the users such as "Good morning"

after a person gets out of bed; “Let’s go” for motivating a user to exercise and even “Hug me” or “Give me 5”. The participants in our focus group agreed unanimously that these kinds of messages are not necessarily motivational but rather sad, that one needs a gadget to get motivated to be healthy.

A: It’s terrible that the sensor should motivate us.

B: Catastrophic!

C: I don’t believe that it can have any stimulating effect.

D: Maybe at first it’s strange, but then you get used to these messages and they become a part of your life...

A: If a person is lazy, no message can motivate her.

B: That could be a conclusion!

(In)equalities

Price of sensors was one of the issues that were repeated many times to make the point that not everybody can have access to these objects.

- *If they were cheaper, I would wear them.*
- *Price is the biggest problem.*
- *I think they are useful but for the majority of us they are unaffordable. I am retired and I certainly cannot buy it to myself.*
- *The price is not low. Besides you need a good smart phone to connect it to.*

A: The government might oblige us by law to wear them.

B: Then they should give it to us for free.

C: Who says so?

A: Do you need to have your ID? Do you pay for it? You do.

Although in the Green paper on mHealth it is suggested that *mobile health will bring more equality to the healthcare system*, many the participants of our the focus groups were sceptical about this suggestion. But they also think that if mobile health is chosen to be the way forward for healthcare, the state should help everyone have these devices if they are necessary for monitoring health and take care of decreasing inequalities.

A: It might be good only for those who already have and use the sensors.

B: Indeed.

C: Now we can argue whether capitalism is good or not.

B: The inequality among users comes from the fact that it is expensive. Also we need skills.

A: It’s not expensive for everyone, but it should be available to all for healthcare; people who are at risk. The state should finance it for people who are on welfare, like they do for an orthopaedic device.

C: If they start selling it to us all, it won’t be that expensive. They will make us pay and take our money for sure.

D: It should be a part of healthcare and available to everyone.

Strong mediation and substitutions

The conversation about motivation and motivational messages offered by sensors continued on another level where the participants discussed the possibilities that messages offered by sensors will replace messages of human beings and that the technology is offered as replacement for social relationships. This has led us to another discussion on the use of technology, i.e. the relationship between the use of technological devices and humans and technology and society on a more general level.

A: I don't like that.

B: Good God!

C: It's like a robot!

A: Female robot!

- *I think that the technology makes people stupid. Children do not even know basic math functions anymore. The calculator is everything. Our brain cells are dying. It thinks for you.*

This discussion appeared again while talking about advantages and disadvantages of mobile health and the relationship between doctors and patients.

A: I think that in near future, the technology and Internet will replace a GP. So, like when you go to the doctor's and say you have fever, pain in the arm and so on, you will type in on the Internet and it gives us an immediate feedback.

B: I don't think it will work. We do not have such infrastructure – who of our doctors use such apps? For the moment this cannot work.

A: It's better to talk to a doctor than to use sensors.

B: To these young generations, it's equal. My boy was born with a computer, for him it's normal. These generations... On the contrary, I also prefer talking to a real person.

C: My son prefers to open his laptop and search for a diagnosis himself.

D: But the sensor won't give us a real diagnosis. It will tell us to take certain pills. And when you go to a doctor's and talk to him, he might prescribe the same, but in a different way. He might suggest you to take them when you feel a specific pain or are in a specific mood. No sensor can give you that! The doctor is necessary of communicating and listening to how you feel.

- *Despite the use of sensors, the communication with doctors is necessary. It's a social component that needs to exist besides a sensor.*
- *Although I think that numbers don't lie (like people do), the contact with the doctor should continue to exist. I only hope sensors could reduce waiting lists, because there would be no need to queue every time to get a referral, if data could be sent through a sensor or an app.*
- *The sensor can help us prevent a condition but we should go to the doctor's to get more insights. The data can tell that you can have a stroke. They tell it to a doctor or an emergency.*
- *I see a sensor only as a warning, a lamp in a car that turns on when something's wrong.*

They also discussed the promises of getting a diagnosis remotely from a medical doctor – where basically imagery substitutes direct contact of doctors and their patients. The move towards mobile health also shifts the responsibility from doctors to patients that many of our participants did not like.

- *According to me, we are going towards that.*
- *For me, the contact is essential.*
- *The doctor will release himself from the responsibility and put it on your shoulders.*
- *It's a big responsibility.*

Also, the majority do not believe that the communication between doctors and patients will improve through mhealth.

- *Very difficult to happen! They spend most of their time on paper-work and least on patients. They don't have time for it! While talking to you, he's typing and half listening to what I'm saying.*
- *As if I was on a market. My doctor usually asks me what medicine I want her to give it to me.*

Nevertheless, there are also people who think it is better that they have the responsibility for their own health.

A: Everyone is responsible for himself or herself.

B: That's it.

A: You're freer and you are responsible for yourself.

B: The education is very important and also the personality, someone will be inert, someone not. Some are more responsible for their health, others less. This will facilitate the doctor's position, but he will still care for all patients.

C: You could become more self-critical, responsible, feel some remorse.

A topic very much connected to this one is how the technology could be used to help people, especially the elderly ones. It is often argued by both policy makers and scientists that the robots will be of a great help to people sometimes even replacing them.

A: It's a luxury, when will it happen here... better hire two carers who will take care of that person, than buying a robot or similar.

MOD: Is it because of price or quality?

B, C: Quality.

A: It's different when the caring person has feelings.

B: Let's say that the problem with elderly people is that they don't want to be alone. And many of them don't like or know how to use the technology.

C: It doesn't mean anything to them.

The majority of participants are very positive about the use of wearable sensors and the improvement of the healthcare system. However, some of them still think critically about the changes that it will bring.

MOD: Could this improve the healthcare system?

A,B: Yes, it can.

C: It can speed it up, decrease the paper work and waiting time.

D: Doctors already have enough patients. Imagine if they had to monitor their patients' health in every moment through the Internet. They could not function anymore!

E: The waiting time would automatically diminish, no more waiting, no more crowded waiting rooms.

F: The same. You won't even have to go to the GP, he sends you immediately to the specialist. So, a direct contact, no waiting, you immediately go to the second level.

G: I would not agree that it will improve anything because I am pretty sceptical about all these things. This is for a personal use and knowledge but it is not very accurate. For instance, we could all put this device on us and it could tell the 3 of us that we have some problems, so we all go to the doctor's and he has to examine us all and maybe non of us is really sick.

The mHealth proposal suggests that the technology will help people who do not have access to the healthcare system now, e.g. living in remote areas etc. However the participants of focus groups agreed that the technology cannot help in this sense.

A: These people who are far away do not have this technology.

B: They do not have the technology, and not to mention other things (skills to use it and so on).

C: The EU supports very high standards for persons with disabilities. It's my job so I know it. Now we have to meet certain conditions, it is a science fiction, so I am not sure if this technology could help. Sensors absolutely cannot. What helps are people and social organisation, laws.

- *People who are in their nineties become children. They are more sensitive than children. And they are eager to communicate. No sensor will figure that out.*
- *I went today to see my grandma. She is 90 years old and I don't believe she would like sensors. She only believes in wine and olive oil!*

But participants also stressed that sensors could be useful for elderly people carers to check their status.

- *I would not mind, not for me, but I have grandma who doesn't tell you anything even when she's sick. For those who take care of elderly it will be an additional help.*

In the same vein of mediations and substitutions viz. à viz. the received tradition about the relationships between patients and healthcare systems:

A: You get something, you lose something. You're losing your communication skills, people don't socialise like some time ago. When people gather, everyone types on their mobile phone, no one wants to talk.

B: The fact is that today's youth is mostly oriented towards mobile phones and Facebook. I always cite the example of my son, he has no money on his cell phone, but he always communicates with someone on the phone. I asked him how do you talk without money on it. Internet! This is what youth do nowadays.

A: They forgot to talk, they are alienating. 20 years ago, let's say, we laughed at people who would come to the Adriatics and sitting separately on the tables. But now, people like to separate from others. Previously, the doors on flats were all open all the time, now everyone has safety door. No more talk, no more communication. Father, mother, child, do not know how to sit down and talk. At home, we usually discussed all the good and bad things, but we discussed at the table. Now it's all gone. Mother comes home at 16h, father at 17: 30h, and the child should be at school at noon. Every day the child eats sandwich, as there's no one to prepare cooked food.

B: That's the answer to how much they will improve the quality of life. The quality of life is a relative term. If the sensors would provide a faster diagnosis, that's good, on the other hand, if they will be absolutely completely alienate us, then better without them.

C, D: See what you get, and what you lose (x2).

It is well-known that society and technology co-produce themselves (e.g. see the works of Latour and Jasanoff, etc.). Many focus group participants observed that people socialise less in the hyper-connected era that we live in, even if the narrative of information technologies is about connectedness and proximity communicating with others.

A: Drastic changes. As technology advances, we are increasingly withdrawing from society, from all. That's my opinion, I do not know about the others.

B: I see it on the example of children; today they are all at home playing games.

C: It should be banned.

D: You can ban it but the English teacher of my child asked us, the parents, to show something to the children on the Internet. Everything goes through technology nowadays and it influences drastically the socialisation, society and all.

C: I would say to that teacher that my child does not have a computer.

A: That's the law!

E: It brings drastic changes in lives of some people!

A: It influences partly positively, partly negatively.

B: it depends on person.

C: It influences now and it will in the future.

D: Absolutely.

E: I expect an improvement.

F: We are forced more and more to have that technology in life so we can have only more technology in the following years.

4.4 Discussion

At the end of each focus groups, participants were asked to formulate statements and address questions to policy makers as a group with regards of usage of wearable sensors in healthcare. The following remarks are hence collective thoughts from the four focus groups.

Uncertain certainties

Participants mostly agreed that wearable sensors might be useful for healthcare if they are accessible to all.

- *Based on the devices and apps, we have concluded that they are useful for the healthcare system, but they are too expensive.*

Some participants expressed their concerns with regards the unknown harmful effects of radiation from these sensors.

A: We have concluded that all of this works on the basis of electrowaves, we will know its consequences in cca. 50 years. It is still a pretty unknown area.

B: Sensors are surely harmful, we just don't know to what extent.

C: Everything is harmful nowadays, ultrasound imaging, X-rays, everything, the question is to what extent.

D: Today it is known how harmful X-rays are because they have been used for 100 years now, while this thing today, these electromagnetic waves... who knows?!

E: They are also harmful, but it depends how much.

F: And they would stick to our bodies all the time. Not only one day. You measure it every day.

Agency and Social Justice

While participants recognise some benefits to use wearable sensors for health, they see as a problematic, the possibility for manipulation and lack of control over their data and accessibility inequalities based on age, cost, etc.

- *There is a possibility of manipulating data, for instance, if someone takes sick leave, as it all goes electronically through sensors, you cannot be sure if he gave the sensor to someone else who is really sick and took the data of that person. Also there are still lots of questions, what data will be online, it should be defined what would happen and to whom the data would be available. Despite legal frameworks, how to limit the data from going beyond from where they should? On the other hand, there could be numerous advantages such as early prevention, facilitated communication with doctors, availability and faster processing, environmental friendly in terms of paperwork.*
- *We think that the data control is still missing and also it will be poorly feasible to create such systems in some rural areas because of no adequate infrastructure. Also, the technology is expensive; it is still very inaccurate. What is the level of tolerance? Then we think that new technology is neither for elderly nor for disabled people- they could serve more a real person assistant. The emergence of hypochondria reduces the quality of the face-to-face relationship between a patient and a doctor. Also the dependency on all the data that are read by sensors.*
- *We feel there is a lack of protection of citizens in the policies, as well as a regulatory and supervisory body that would deal with personal data. There is still missing information and training on how to use the new devices and tools as well as the awareness of the use of devices. People should be able to choose how and when to use them.*

In a word "ethical concerns"

The participants also listed at the end some of the key words that emerged from the discussion in the focus groups. They are: speed, technological advances, future, healthcare necessity, questionable accuracy, control, availability, simplicity, affordability, education, data security, coordinated health standards, privacy, competency in handling the data, abusiveness.

5 Reflections and Recommendations

In this section we offer specific recommendations for the 3 cases, as way of guidance for further social research on ethical issues with regards to the development and deployment of the three cases we have looked at: Open Internet of Things, Civil Drones and Mobile health through wearable sensors.

We also offer some reflections about the methodology of “ethics dialogues” that we have tried to exemplify here, indicating what we see as next developments. We finally offer a thread about future developments on maintaining such dialogues.

5.1 Open IoT

Our work focused on the potential and limitations of DIY and Maker trends and spaces to advance and promote the ethical, cultural and social issues of autonomy, empowerment, control and diversity in the design, fabrication and production of new technologies, starting within the domain of IoT but expanding to a multiplicity of scientific and technological domains. The focus was on how certain values and practices are being enacted in these trends, characterised by distributed, collaborative and peer-to-peer tools, platforms and spaces, towards the goal of enhancing dialogues with expanded groups of citizens.

We are witnessing an increasing number of individual and collective actors - from crafters, hackers, artists, designers, scientists and engineers, to amateurs, hobbyists, entrepreneurs, companies, students, professors, researchers, children, communities, and civil society organisations – actively creating, experimenting, producing and distributing alternative solutions on their own and together with others, locally and globally, or as part of local projects, as response to their own everyday needs, or as the pursuit of new products and services.

The narratives in DIY and Maker trends are very powerful in supporting the engagement of citizens in scientific and technological development. **The main DIY/Maker guiding beliefs, values and ideals relate to sharing, openness, collaboration, creativity, freedom, access, equal opportunity, and also to fairness, non-discrimination, diversity and equality.**

Empowerment and democratisation in the access and use of technology are at the core of such trends, and correspondingly, in a number of current spaces for open and personal fabrication, such as Fab Labs, Hackerspaces and other Makerspaces. These settings stand as the physical and community contexts where citizens from different backgrounds, skills and knowledge, are accessing tools and machines, getting support and assistance, connecting with others to learn and exchange ideas, and finally developing their ideas into prototypes and products.

Looking in more depth into one of these contexts, the Fab Lab network clearly defines its goal of democratizing the access to the tools of technical invention, and thus supporting a community as diverse as possible, including fabricators, artists, scientists, engineers, students, or amateurs of any age. By giving access to tools and communities that share common interests, the expected result is to allow anyone to make anything, with the explicit purpose to improve lives around the world. In short, the ideas of participation and empowerment play a central role in the mission of Fab Labs. For instance, the Fab Lab Charter offers a number of guidelines that underline the importance of access to tools, sharing, assistance, community, responsibilities of safety, operation and knowledge dissemination, and freedom to develop innovative solutions.

In our analysis it became clear that making something leads to new types of thinking and acting in the world, that is, it stimulates not only learning new sets of skills, but also a new awareness regarding the possibilities of experimenting and accomplishing new ideas.

Through hands-on experimentation, citizens gain an understanding of the operating schemes of objects, they figure out how to fix them, find new solutions to repurpose them, or develop their own solutions. In a more fundamental level, Makerspaces such as Fab Labs are offering alternatives model for local and micro production, based on the realities of open source, peer-to-peer production and collaborative commons. In this new framework, citizens find opportunities to become creators and producers, instead of passive consumers of commercial or pre-packaged goods and services.

An open access to the Fab Labs has proven essential to connect with new users, to develop a community, and to collaborate and to build partnerships with other organisations, such as other Makerspaces, museums, universities, art and design festivals, libraries, or local and national government bodies. In this sense, the Fab Lab network has demonstrated the relevance of a number of engagement strategies and mechanisms, such as Open Days and guided tours, a space open to the public (if resources allow it), initiatives with external partners, workshops and master classes (where new users learn how to operate the machines, or they conduct a specific task or project, such as ‘build your own 3D printer’ or ‘your own drone’), and also the experience of Mobile Fab Labs (a mini Fab Lab with the same machines housed in a trailer or a truck). In most Fab Labs there is a strong educational investment to connect to students and communities, and in fact, a strong concern for promoting STEM education.

Openness and sharing are the basic ways of working in such spaces, although they lack mandatory or formal procedures to ensure collaboration and dissemination. As initially noted in maker/hacker philosophies, informality is predominant. Exchange of ideas and knowledge is done through random encounters and talks, fuelled by curiosity about other people’s on-going projects. Discussion over the need for documentation and sharing mechanisms is constant, coupled with awareness that there is a lot of implicit knowledge inherent to the physical character of manufacturing something that is hard to translate and to document.

The value of freedom to develop whatever you want or need is clearly one of the central tenets of such spaces, seen to be the main drive for creativity and innovation. Most of the times there is an absence of formal rules or procedures, and instead informal control and monitoring within the community is preferred. This is also one of the reasons there are few reported situations of refusal to host or to help with projects deemed to be inadequate or inappropriate. **Ethical discussions are usually limited for instance to educational projects, where more attention is put into the type of objects that will be produced, or in highly public controversies such as the 3D-printed guns.**

Although values such as responsibility, social justice or sustainability are not usually an explicit priority or stated purpose for most Fab Labs, there are a number of projects that pursue such objectives. Our analysis shows for instance that sustainability is a recurrent topic of discussion in a number of initiatives. A great concern among the Fab Lab community relates to the models of funding and management of Fab Labs, usually in terms of its continuity and available resources, but also regarding possible ethical conflicts of public and private funding. At this moment a pragmatic attitude towards private funding prevails, with no objections most of the times towards accepting grants or establishing partnerships with corporations. Nevertheless, the discussion over the ethical implications of such partnerships is present in some instances. Issues of transparency and also the original mission of Fab Labs to improve the lives of citizens and communities are put into question in present and future funding and management models.

As a result of our analysis, we present the following set of recommendations for the pursuit of future research and the development of policy priorities:

- Closer attention to on-going changes of citizens into active creators, inventors or producers, which entail transformations of usual channels and spaces for innovation, beyond conventional or traditional sites as academic, government or corporate labs or research centres;
- Reinforce opportunities of collaboration between DIY and Maker communities and other institutions, organisations or associations, thus learning from their hands-on approach to tackling problems and coming up with innovative solutions, and benefiting from their local implementation and connection to citizens and communities;
- Promotion of values of inclusion, diversity and equality in DIY and Maker initiatives and spaces, for instance by setting specific goals in direct support and funding of educational programmes, regional development in relevant topics, or entrepreneurship projects;
- Boosting digital skills and learning in such DIY and Maker spaces, giving full attention to the issues of diversity, inclusion and equality;
- Support for infrastructure capacity-building of such spaces in terms of availability of human resources, connectivity, machines and tools, thus allowing them to function in close cooperation with public or government services, departments or institutions;
- Further analysis of new lifestyles and behaviours that will emerge through DIY and Maker cultures, in terms of sharing of practices, promotion of sustainability, and other non-material values;
- Further examination of new paradigms of open innovation, peer economies, collaborative commons and open source and their disruptive impacts in all domains.

5.2 Civil Drones

The ethics dialogues about civil drones explored visions about these, identifying the boundaries of acceptable use, and examining the robustness of the assumptions and ethics embedded in the strategies for managing *public acceptance* in the ERSG (2013) roadmap. In the following points, we summarise the insights that are most relevant to this aim.

- First impressions of civil drones sometimes draw upon cinema and television references, but more often refer to direct experience or incidents involving civil drones reported in the press. These more often refer to nuisance and surveillance, and seldom to military drones.
- The *killing machine* vision does not adequately capture the participants' perspective on civil drones, and the assumptions embedded in the strategies for managing public acceptance in the ERSG (2013) roadmap do not appear to be robust.
- A *full skies* vision was prominent. Combined with concerns about function creep, this may present a challenge the acceptability of the civil drones.
- The boundaries of acceptability are drawn at seriousness of benefits
- Misuse of various kinds biggest problem.
- Authorised users, trust.
- Solutions often draw analogies with cars- licencing, registration, identifiability, responsibility, liability.
- Interesting point on surveillance

The results can be used directly to inform civil drone development strategies. In particular, we believe that they provide an early warning for many actors that have developed tacit and explicit strategies for public acceptance of civil drones that are based upon unfounded assumptions and dubious conceptualisations of the relationship between technology and society. The project can also be used as a pilot study for follow-up research, which could

examine specific features in depth or seek to provide more robust and representative information, e.g. at a pan-European scale.

Many of these insights can be used directly to inform ongoing civil drone development strategies. In particular, we believe that they provide an early warning for many actors that have developed tacit and explicit strategies for public acceptance of civil drones that are based upon unfounded assumptions and dubious conceptualisations of the relationship between technology and society. To these, we repeat the recommendation of previous analyses (Boucher, 2014a, 2014b):

Rather than seeking to make citizens *accept civil drones*, we should make civil drones *ethically acceptable to citizens*. Strategies to manage public acceptance should focus upon reflecting citizens' values in the technology, and give citizens a role in shaping its development.

5.3 Wearable sensors

In the ethics dialogues', participants from two countries with different demographic characteristics and background, were either users or non-users of wearable sensors. Although the users sometimes were more knowledgeable about a particular sensor (how it works or what it is used for), we noticed that the opinions and attitudes were not based on the use of them, i.e. there was not a clear-cut distinction in opinions between users and non-users. The discussion in focus groups started with materiality of wearable sensors, continued through main ethical issues identified by participants through their own words and articulation; ending with broader discussions about technology and society and specifically about healthcare systems policies.

Although citizens' imaginations about *healthcares* of the future mostly correspond to those of industry and policy makers (such as that sensors represent the future of medicine and wellbeing), we can say that the discussions held are totally beyond it. The invitation to dialogue that we have created through the methodology has prompted critical thinking towards the use of wearable sensors as well as the usefulness of mobile healthcare system. The participants were not so convinced about the technology as *deus ex machina* the way in which technology is often presented in policy documents. Based on audio-visual material from traditional and online media and advertisements, i.e. the types of messages that are there and that we are all exposed to in relation to wearable sensors, participants confirmed or raised several questions and ethical issues that need to be further discussed.

The most important topics that were discussed focused on data protection and privacy, i.e. what happens if all our (health) data are put in the (Internet) cloud? who will have access to them? who will have control over it? Participants also stressed the positive opportunity of self-tracking and other DIY initiatives through wearable sensors, such as the prevention of certain diseases, the empowerment over ones' own health issues and the advantages they bring to professional sportspeople. The accuracy of wearable sensors is another sensitive issue that needs to be resolved if the sensors are to be taken seriously. They were also discussing about sensors' actual usefulness *viz. à viz.* industry's strategic messages to increase their sales. Inequalities in accessing wearable sensors, skills divides and uncertainties with regards to potential effects of radiation produced by wearing sensors 24h were deeply considered.

However, the majority of participants were positive about the introduction of sensors in healthcare, even if they saw a need for discussing the cultural and societal challenges introduced by these types of technologies. Expressions like loss of communication, alienation were spontaneously prompted together with reflections about strong mediation of technologies in the ways we communicate today. For example, using robots for helping elderly was not seen as a good practice, because having a human being with feelings is much more appreciated.

Addressing ethics through dialogic methodologies have helped us understand that citizens will play a role in decision-making processes in relation to wearable sensors (or any other technology for that matter) as to the ways they can or will be used. There is nothing really new about this, but what is new is that developers and promoters can no longer get away with un-discussed deployments of technology especially in sectors where citizens are major stakeholders, like health. Having said that, many participants expressed their lack of agency, feeling considerably detached from the process of influencing the outcomes of technology development and deployment, fearing that wearable sensors or mobile healthcare will be eventually imposed to them, constraining their choice. Paradoxically (or not so much) the narrative with which such devices are sold is based on individual empowerment and agency. The DIY movement however, is challenging disempowerment of citizens; the issue for those who conduct research and innovation in this sector is to decide whether they want to engage now in dialogues that will lead to socially robust technology or if they are rather prepared for countercultures.

We would argue that ethics dialogues, inclusive of citizens that deliberate on values and norms in connection to new technologies is a condition *sine qua non* for trustfulness on policy making in Europe. The discussions held requested that debates about what values and what norms should be by design be open in technology development cannot be narrowed down to policy makers, industry and other experts; the participants of our focus groups suggest that they should be opened to **other citizens**, as in the end we are all guardians of received wisdom, values and norms.

5.4 “Ethics” dialogues

The insights described in the previous sections demonstrate the depth of understanding that can be achieved through dialogues based on in-depth interviews and focus group methodologies. While the results may not be taken as representative of European citizens, they can help us understand a great deal about how citizens’ understand, make sense of technology that permeate vital and traditional aspects of our lives.

The people we have involved in our social research were not only users or potential users of technologies, but also makers of these technologies. Hence, on approaching ethics through these dialogues we have explored here not only the experience of ethics in technology appropriation but also the very experience of ethics through the construction of artefacts and services by the DYI movements.

Different types of engagement allow for different types of experiencing and deliberating ethics. In this case we have addressed the issue through usage and making, which shape technologies and the experience of technology in very different ways.

We suggest that RRI needs to take stock of these very different ways of experiencing ethics in the call for ‘public engagement’ and in the call for ethics assessments.

Based on the overarching idea of having ethics dialogues about new technologies, one can think further of how these dialogues could be further designed and used to foster RRI. The ethics dialogues experiences described in this report were organised with several goals namely on understanding the experience of ethics by citizens (users or makers) with the three types technology; although not introduced explicitly ethics discussions emerged naturally. That is per se completely expected; but as researchers, we have been surprised that users and makers make sense of their agency in very different ways. Thinking about future developments for this type of methodology resides precisely on creating opportunities for citizens to deliberate about the types of agency we wish to have about different technologies. We contend also, that this should also be the aim of responsible research and innovation, through a larger project that makes ethics assessments in science and technology a dialogic endeavour which in times of constitutional changes (Arendt 1958; Jasanoff 2013), seems to us inescapable.

5.5 Final remarks

Central to the three technologies is the fact that these technologies are being developed and appropriated in Open fashions, with an extended community of actors involved in different ways of producing, assessing and governing knowledge, of learning, experiencing and experimenting. These technologies are being triggers of grassroots developments, changing the *loci* of innovation and creativity, or better said, reinforcing *loci* traditionally confined to local geographies and temporalities that with Internet have gained other dimensions.

Hence in the talk of RRI, the pillars public engagement and ethics have completely different dimensions from the ones described or ascribed to research communities. The “Open paradigm” (e.g. Steele 2014), extended peer reviews and communities (Funtowicz & Ravetz 1992) have been changing innovation and research to the extent that quality, legitimacy

Pursuing “ethics dialogues” means here that we maintain the choice of how we want to live with technologically mediated processes that are different from the received tradition about human relationships: care, dialogue, creativity, etc. and are not simple followers of un-discussed imposed *normativities*.

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