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Mid-term Report

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6	Open Rights Group	ORG

Dissemination Level

PU	**Public**	**X**
CO	Confidential, only for members of the consortium (including the Commission Services)	
EU-RES	Classified Information: RESTREINT UE (Commission Decision 2005/444/EC)	
EU-CON	Classified information, CONFIDENTIEL UE (Commission Decision 2005/444/EC)	
EU-SEC	Classified information: SECRET UE (Commission Decision 2005/444/EC)	

Dissemination Type

R	**Document, report**	**X**
DEM	Demonstrator, patent filling, videos, etc.	
EU-RES	Classified Information: RESTREINT UE (Commission Decision 2005/444/EC)	
O	Other	
ETHICS	Ethics requirement	

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Mid-term Report

1 Executive summary

Despite rapid news cycles, technology reporting is characterised by anxieties about the consequences of pervasive connectivity. Stories abound about irresponsible data practices, and the challenges internet of things devices present to European values and society. Yet little is known about how IoT innovators and developers across Europe are making ethically consequential decisions for connected devices they develop.

To address this need, the VIRT-EU consortium has, over the last eighteen months, been working to explore the existing landscape of development culture in European countries. Our project objective is to secure a place for societal concerns in the generation of new technologies. As a project with roots in responsible research and innovation (RRI), ethics and ICT practices, we want our interventions, both through design spaces and ethics impact assessment, to be empirically grounded, and widely adopted. The research we have conducted to date lays the foundation for these interventions to be well informed, and the present document presents findings from across the consortium, demonstrating mid-way findings and identifying directions for future research.

VIRT-EU data comes in several distinct forms. We are a project based on collaboration between different disciplinary and methodological approaches. As such, we have organised our reporting in such a way that these distinct contributions can be discerned, and their points of intersection explored.

First our findings from the network analysis research, based initially on Twitter data, explore the breadth and limitations of the global #IoT hashtag. The data show how, due to the volume of tweets generated on this channel, a honing of focus for tuning to European specificities has been necessary. Findings from the first year of exploratory ethnography at key IoT-related events provided the foundations for a consolidated dataset that begins to show the shape of European discourse spaces of IoT through the networks of followers.

Second, we have taken our project starting point in virtue ethics and put it in conversation with ethical frameworks that have emerged as relevant through our empirical research. Articulating a common stance within the project has necessitated desk work on the structural issues faced by IoT developers, and its relation to the capabilities approaches within philosophical ethics, and the practical frameworks of care ethics. In this synthesis, the project shows that its awareness of what will be appropriate for practice has been informed by observing practice.

Third, our reports from the field, from all empirical sites show that while there is high engagement with questions of ethics, the breadth of how ethical questions are addressed is in need of clear mapping. Our network ethnography model is designed to be adapted to the social, cultural and innovation dynamics of the kind of hyper connected societies currently emerging. Data show the thematic, organisational, institutional and professional entities involved in the emerging IoT ethics landscapes, working from our primary sites in London and Amsterdam, supported by research taking place in Copenhagen and Malmö.

Fourth, the PESIA framework as a legally informed tool for impact reflection has been under development. Rather than simply summarising the values upon which recent legal decisions are based, the VIRT-EU team have synthesised baseline values that, in line with the aim of the project, provide the foundation for a tool that can contribute to change the existing paradigm.

Finally, design-based prototypes are under development to ensure relevance and uptake within user communities: the synthesis work from design workshops and early prototyping shows the importance of sustained and critical engagement with the future implications of present design and data use.

Overall, VIRT-EU mid-way data shows a European landscape of IoT development characterised by high interest in, but little knowledge of how ethical questions can or should be addressed within the development process. Components of each of the disciplinary approaches, from design to legal review, assist us in engaging closely with practitioner interlocutors, and in our overall goal of proactively positioning ethical self-assessments in the development of IoT technologies.

2 Introduction

The VIRT-EU consortium's research on values and ethics in IoT design and development is taking place in a changing policy and cultural landscape. The recently introduced General Data Protection Regulation (GDPR, came into effect 25th May 2018) (European Parliament and Council, 2016)[1], reflects mounting public concerns around data practices, and national news stories run weekly raising alarm about data practices and data ethics. Discussion about data use is becoming pervasive across sectors, demonstrating the centrality of questions of value and ethics in making responsible technology. But what does this mean for next generation IoT innovators, whose connected devices both generate vast amounts of potentially valuable data, while posing extensive concerns for privacy and surveillance?

Through VIRT-EU work, the ethics discussions of the European community of IoT development, particularly the challenges faced by designers and developers of IoT devices in practice, are becoming evident. Our project has four overall guiding aims:

- Empirically identify how local culture and network society influence the understanding and movement of particular social values among technology developers
- Develop a framework for impact assessment that considers privacy, ethical and social impacts.
- Co-design self-assessment tool prototypes with technology developers
- Test implementation of these prototypes and processes within the European data protection landscape.

At this mid stage of the project, we are deeply engaged in the first three listed above, with the next phase moving towards ethnographically informed design prototyping, testing and implementation. This will bring us closer to our project goal of building collective and social resilience in an age of individual subjectivity, linking scholarship and advocacy on data protection to ethnographic observations of designer and developer ethics in practice.

[1] European Parliament and of the Council. 27 April 2016. Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) (Text with EEA relevance)

VIRT-EU work is thus inherently interdisciplinary, and aimed at integrating modes of analysis for different academic traditions. In the research conducted through VIRT-EU so far, these interdisciplinary collaborations have been put to work to map conversations were happening about ethics in relation to the Internet of Things. Building on the collaborative custom software and interfaces, we have been able to combine qualitative and quantitative insights, and the details of our emergent consolidated dataset are contained in this report.

Considerable desk-based research in the legal and policy research teams is now coming together. This work informs two sites of VIRT-EU intervention: an overview of existing ethics tools, and a comprehensive legal analysis of values present in case law. As we move into the central phases of the project, our common task is to bring these components of research into dialogue towards our common design intervention and impact assessment tasks.

The content of this report is organized in the same order as summarised above. We first provide an overview of the conversations about IoT in online environments via an analysis of the #IoT hashtag on Twitter and discuss the work that has gone into merging qualitative and quantitative insights through the consolidated dataset of key actors in IoT discussion spaces. We then present an initial practical framework for ethics that drives research and analysis of ethnographic work, connecting it with legal analysis and design practice, put forward as an orientation towards ethical intervention. We then present outcomes of our ethnographic work on the embedded assumptions and reasoning being done in practice, organized by field site. Findings from these enquiries have informed the co-design field workshops, and contributed substantially to the consolidated dataset. The legal analysis puts forward the PESIA model, which takes into account privacy, social and ethical issues in its impact assessment. It is based on the analysis of decisions adopted by data protection authorities in the European Union, identifying which ethical and social values have underpinned decisions taken by these entities. Design research findings and prototypes emerge from these discussions, and their embeddedness in ethnographic specificities. We conclude with an overview of practical project activities, project management and dissemination efforts.

3 Birds-eye view of IoT - quantitative inquiry

The VIRT-EU project was designed from the ground up as an interdisciplinary inquiry, grounded in the idea that in order to follow ethics as values in action, we must be able to observe and follow action across both physical and digital spaces. The quantitative analysis of online discussions conducted to date provides an overview of how IoT is thought of and discussed broadly online but it does not allow us an in-depth geographically situated inquiry. In order to address this problem we have used the insights and contacts gained in the course of ethnographic and physically situated fieldwork to seed the overall #IoT dataset in order to focus our analysis on a more geographically situated sample. In this way we hope to be able to eventually compare the European discourse about IoT with the general world-wide set of concerns and discussions. At this stage of the project we have completed the development of custom software for interdisciplinary data collection and analysis, sample selection and initial model development. Below we describe our progress beyond that described in the annual report (See deliverable 1.2).

3.1 Collection of online data from online platforms and data design

Task 2.1 (Collection of online data from online platforms) on-going to complete in M28

The quantitative analysis of the IoT space is based on data collected by the data acquisition tools developed in task 2.1 and detailed in the annual report. The tools that are part of the first three tasks have been developed specifically for the project, with the exception of the tool to collect tweets which was produced by extending existing software. These tools have been used by project members from different units to facilitate interactions between the qualitative and quantitative methods of data analysis. While the data collection tools include Twitter and MeetUp data, this report will mainly present the results of the ongoing analysis of Twitter data.

This includes: a) a general description of the #iot hashtag as a global topical space for IoT related conversation; b) a description of the *consolidated* dataset of European key actors in the IoT space; c) a preliminary analysis of the Twitter activity related to the consolidated dataset and d) the research activities planned for the next months.

a) The #iot hashtag

To get an overview of the online discussion of IoT we have been collecting (and will continue to collect) all of the Twitter data containing the #iot hashtag for approximately 12 months. However, we realize that these data cannot be used to provide a representative picture of the topics discussed in the IoT domain, because (1) it is not possible to know if or how the tweets obtained from the Twitter API itself are sampled, (2) Twitter is not uniformly used across Europe and across different types of users, (3) it is not the only discussion space for IoT, (4) not all IoT-related topics are marked with the #iot hashtag and (5) not all tweets containing #iot concern the IoT. In addition, only a small percentage of the tweets are geo-localized, and we cannot know whether this is representative of the geographical distribution of all Twitter users in our data. Therefore, given the original goals of the project, the role of this dataset is to mainly identify relevant themes and locations emerging from the data source, to provide input to the qualitative team.

The following two figures show, respectively, the temporal distribution of about 8.5 million tweets collected from mid May to mid November 2017, and the geographical distribution of the geo-localised tweets contained in this dataset.

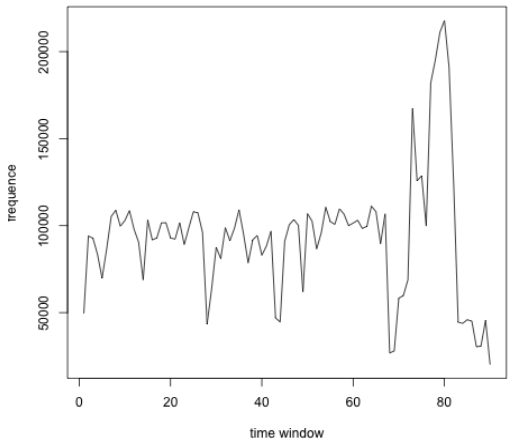

Figure 1. The temporal distribution of about 8.5 million tweets collected from mid May to mid November 2017

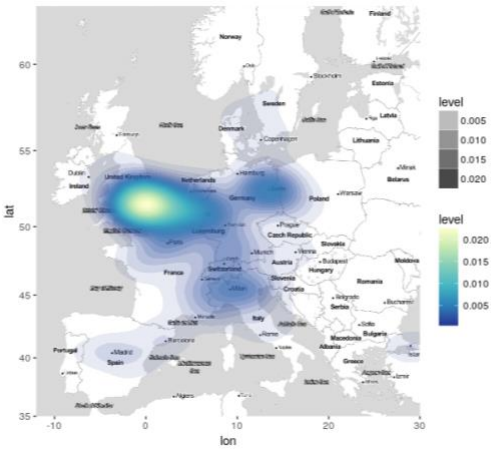

Figure 2. The geographical distribution of the geo-localised tweets contained in this dataset

Task 3.2 (Pattern identification & cluster analysis) on-going to complete in M28

The list of the most frequent hashtags (used together with #IoT hashtag), helps us to generate an initial list of the most popular topics contained in the dataset. We manually analyzed this dataset with the help of the qualitative team to (1) remove unrelated hashtags, (2) improve quality, e.g., fixing misspellings, and (3) select a list of themes that are relevant for the project, corresponding to the following: #iiot, #fintech, #finance, #blockchain, #cryptocurrency, #cybersecurity, #security, #itsecurity, #iotsecurity, #datasecurity, #infosec, #ar, #vr, #analytics, #dataanalytics, #predictiveanalytics, #ai, #artificial, #machinelearning, #deeplearning, #datamining, #hardware, #arduino, #raspberrypi, #3dprinting, #smartdevices, #devices, #sensors, #wearables, #smart, #smartbuilidings, #smartcity, #smartcontract, #smartdevices, #smartgrid, #smarthomes, #smarthome, #smartmobility, #smartphone, #smarttech, #smarttechnology, #gdpr.

Based on this, we have used the list to transform the data into a set of conversational networks, in order to attempt to identify temporally evolving discussion groups. However this activity was not successful using state of the art methods, for two main reasons. First, a large number of bots are contained in the dataset. These dominate the discussion groups automatically extracted by methods that do not distinguish between bots and humans. Second, the discussion network extracted using explicit mentions between users is very sparse, and thus it does not contain sufficient information to identify many strong discussion groups despite the size of the data. These problems are currently being addressed by the quantitative group. In particular, we have developed a topical model, presented at the SunBelt INSNA conference on social network analysis in June 2018 and to be published in the proceedings of the conference on Advances in Social Network Analysis and Mining (ASONAM)[2], based on a new way of representing temporal text networks[3], that we are currently testing on the large IoT data.

[2] Hanteer, O., Rossi, L., Vega D'Aurelio, D., & Magnani, M. (2018). From interaction to participation: the role of the imagined audience in social media community detection and an application to political communication on Twitter. *Proceedings International Conference on Social Network Analysis and Mining*, Barcelona, Spain.
[3] Vega D'Aurelio, D., & Magnani, M. (2018). Foundations of temporal text networks. *Applied Network Science.* (forthcoming)

b) The consolidated dataset of European #IoT key actors

Task 3.1 (Definition of prestige & centrality analyses) completed to support completion of Task 3.2

The analysis of the global #IoT hashtag stressed the need for a more precise way to identify relevant online conversations about IoT, especially among European actors. This has been done by identifying a set of key actors participating and steering the on-going IoT conversation in Europe. In the context of this report we will refer to this set of key actors as "consolidated dataset". Following the interdisciplinary approach of the project, the definition of key European actors relied on the knowledge produced by the on-going qualitative exploration of the EU IoT space. Based on the experience and localized knowledge that the VIRT-EU researchers have been accumulating for more than one year, we have developed a common set of inclusion criteria to identify which actors to add to the consolidated dataset. These criteria aimed at ensuring that the members of the consolidated dataset were not only relevant from the local perspective of the respective field sites (London and Amsterdam), but were also able to provide data to be used to test the main hypothesis related to the project. Therefore, besides social media identities and the main areas of activity, the researchers also provided specific information about the background of the actors and whether they are involved in discussions of responsibility and ethics with respect to IoT technologies. This resulted in an enriched dataset containing 112 qualitatively selected actors relevant for the European IoT space. The actors were manually imputed into the consolidated dataset and described according to an extensive list of attributes (Table 1):

Attribute	**Description**
Name	*Full Name*
Type of Actor	*Single person or Organization*
Gender	*Male/Female/Non-binary*
Social media IDs	*Social Media IDs*
Location	*City and country of main professional activities*
Background	*Education and/or prior employment*
Type of Activity	*Start-up/Consultancy/SME/Government/Academia, etc.*
Areas of Activity	*Sub-field of IoT*
Participation in the public discourse about Ethics and IoT?	*3 points scale*

Table 1. List of attributes collected for each actor in the consolidated dataset

The consolidated dataset allows the research project to develop two parallel and complementary lines of research. On the one hand the high quality of the data, gathered through qualitative analysis and

ethnographic observation, makes it possible to associate ground truth knowledge with specific network actors. Using the network built from the consolidated dataset, it will be possible to investigate the impact of personal characteristics and ethical stance on the flow of IoT-related communication with higher reliability. On the other hand, these 112 relevant actors will be used as seeds for a network sampling strategy aimed at collecting an extended network of key European actors in the IoT field. Further details about the extended network will be discussed below in the Future research section.

c) Analysis of the consolidated Twitter networks

Task 3.2 on-going to complete in M28

The analysis of the Twitter network generated from the 112 actors in the consolidated dataset has two main goals: on one hand it aims at exploring in details specific research questions related to the drivers behind online communication using, as data source, high quality data with a level of detail that is not available as traditional social media data. On the other hand it seeks to provide an opportunity to test and further refine the network metrics that have been developed in the initial part of the project and applied on a larger network representing the extended network of European IoT actors.

The Twitter data produced by members of the consolidated dataset is represented through a multiplex network that contains different types of relations among users: following relations, retweets, replies and participation with shared hashtags. Here we present the results of the initial analysis of the following/follower network between these users.

Figure 3. Geographic distribution of the FF network of the consolidated dataset

The following/follower network (FF) only includes the relations existing between the members of the consolidated dataset. The connections with members that are not part of the initial group of users will be analysed in a different network. The FF data clearly shows the existence of a relevant network among the members of our consolidated dataset with only 9 members that are not connected with any other member. The resulting network shows a relatively high density (0.11) a high level of average connections (avg degree = 12.6) and suggests small world characteristics. (Clust. Coeff. = 0.45, avg. path length = 2.11). Moreover it is observed that the FF network is characterized by an extremely high reciprocity value (0.99) suggesting that members of the consolidated dataset mutually recognize each-other as relevant actors. In Figure 3 we can see that while the members of the consolidated dataset offer a good coverage of the continental diversity, from a quantitative perspective they show a clear presence of geographical hubs where the discourse about IoT technologies (as well as the development) takes place (Figure 4).

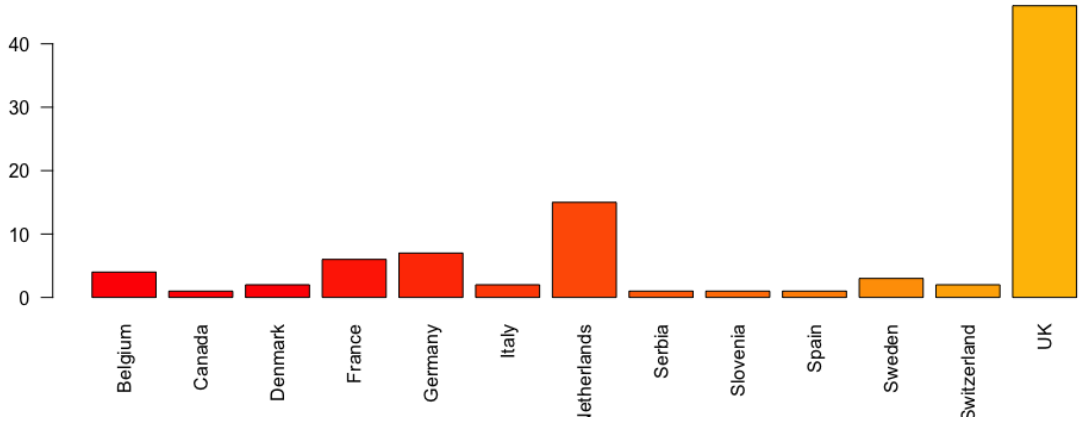

Figure 4. Geographical distribution of ethnographically identified significant actors in the European IoT community

Starting from this network the initial analysis is built on the identification of existing communities or sub-groups within the shared space of European IoT actors. The densely connected network does not show a clearly identifiable internal community structure, nevertheless an automated analysis (performed using the Louvain algorithm) suggests the presence of 4 main clusters as visible in Figure a. Using the additional information available in the consolidated dataset it is possible to explore clusters through a homophilic process to verify if any of the individual characteristics of the actors could be responsible. Figure 5b, Figure 5c and Figure 5d show the consolidated network. They highlight the background of the individual actors, their geographical location and their participation in the public conversation about ethics and IoT. The individual's background doesn't seem a valid explanatory variable for the observed community structure with the different types of background evenly distributed through the various communities. The nominal assortativity value for this individual attribute is close to zero (0.062). Similarly, even if more surprisingly, the geographical location seems to not affect the cluster structure with the country of activity even when it shows a slightly disassortative behaviour (nominal assortativity: -0.042) as if actors were more likely to follow each-other if they did not operate in the same country. Figure 5d, that colours the nodes according to their participation in the online discussion about ethics and IoT, interestingly the participation to the ethical discussion is the attribute that results in the highest value of positive assortativity suggesting that a common ethical perception (or at least a common participation to the public online discussion about ethics and IoT) is a meaningful element of homophily between actors when it comes to establishing following and followers relations.

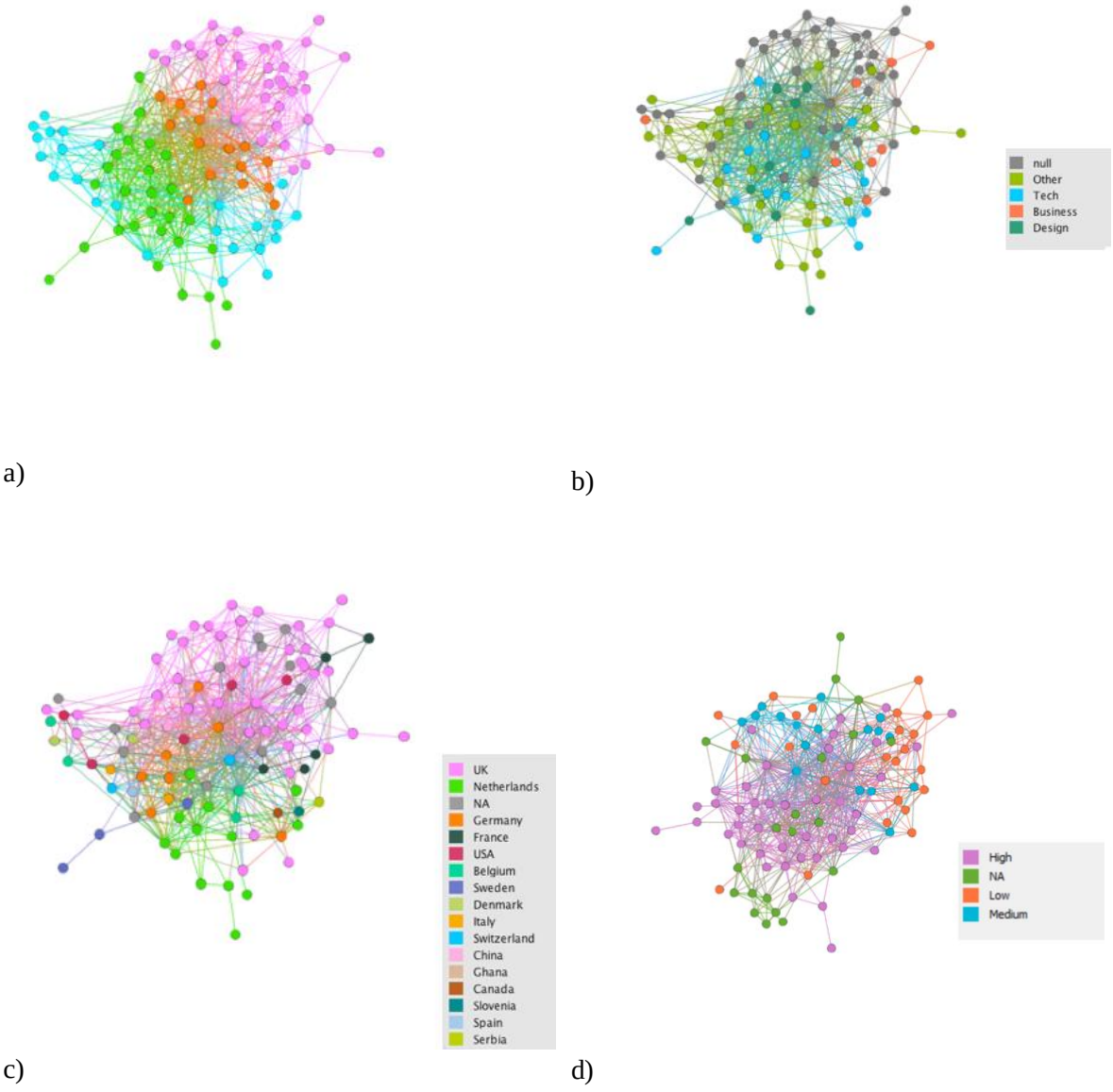

Figure 5. a) 4 main clusters and b), c), d) consolidated network

These preliminary analyses suggest that neither specific background nor the geographical location of the members in the consolidated dataset seem to explain the existing network structure between those members. In the case of the specific background this might not be surprising - as one could easily expect a complementarity between members with different backgrounds - but the results of the geographical locations may be of particular interest. This is for two specific reasons: first, social media has often been observed to replicate pre-existing offline structures and relations where local physical contexts always played a major role in explaining contemporary online networks. Second, existing local communities emerge, also from the ethnographic exploration, as a central element to fully understand the processes,

the practices and the culture of IoT design and development in Europe. Moreover, the data suggests a small but relevant effect of shared attitudes towards ethics as a predictor of online relations. This preliminary analysis suggests the potential existence of an IoT space beyond the spatial and professional similarities.

d) Future research

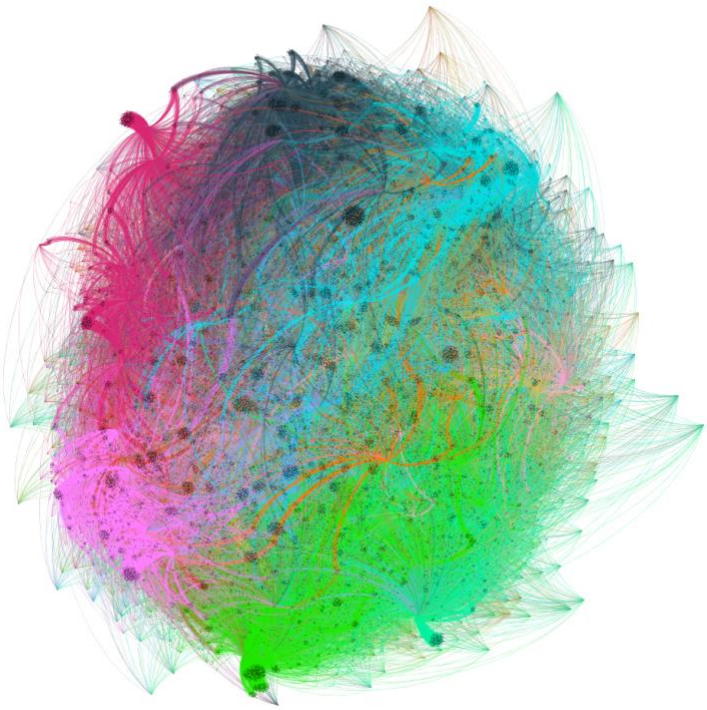

Figure 6. Modularity structure of the extended #IoT networks seeded with the consolidated dataset

The analysis presented in the previous paragraph focused on understanding the structure of the Twitter following/followers network among the members of the consolidated dataset. In the coming weeks the existing FF network will be complemented with three more types of information that are currently being collected: actors' retweets, actors' replies and actors' participation in hashtag conversations. These new data will then be organized as a multiplex network structure as described in the annual report and new analyses aimed at detecting and explaining the existing community structure will be performed.

Task 3.2 leading to foundation for Task 6.4 (Measurement of structural changes in developer communities)

Moreover the consolidated dataset has been used as a seed-network to identify an extended network of Twitter actors relevant in the European IoT Space. This has been done through a two-step process:

1) All the followers of the actors present in the consolidated dataset have been collected as organized as a network *g*.
2) *g* was filtered so that only the nodes with degree > 1 remained.

Those two steps allowed us to create a network of actors that clearly showed an interest towards the content shared online by at least one member of our consolidated dataset but at the same time to limit the distortion due to the collection strategy that was prone to produce a structure characterized by the seeding nodes at the center of largely disconnected clusters. The resulting *extended networks* are composed of 51935 nodes and 160360 following/follower relations. The resulting network (Figure 6) is characterized by an average degree of 6.17, a network diameter of 6 and an average path length of 2.55. As expected, due to the selection process, the clustering coefficient is lower (0.001) even if it is still higher than what is expected from a purely random graph of comparable size. A modularity optimization approach identifies 11 communities and a clearly modular structure (0.41). While the modularity value might be partially due to the strategy used to create the network the qualitative interpretation of the communities has not been performed yet and it will constitute a future activity.

As we move forward with the project we will investigate much more closely the curious influence of participation in ethical discussions on similarity and assortativity. However, in order to intervene and discuss ethics, we first must consider what sort of practical framework for ethics the VIRT-EU project can use. We consider this issue in the next section.

4 A practical framework for ethics

Task 3.5/4.5 – output from analytic seminar for interim exchange between WP3 & WP4

In order to identify a range of ethical directions the project might employ it is first important to discuss and refine the general ethical stance articulated by the project. In conceptualizing ethics as values in action we draw upon the basic idea that ethics is a process of the application of values in human conduct and this process guides understanding and decision-making. Going beyond the Aristotelian conception of the importance of doing the right thing in service of living a good life, the VIRT-EU project focuses on the practical side of how sometimes complementary and occasionally competing values are expressed and enacted in practice. Yet the simplicity of conceptualizing ethics as values in action overlooks the importance of the position of power that developers and designers of IoT technologies may find themselves in.

As connected devices and services proliferate, data collection and algorithmic processing become less visible and potentially more invasive for the people that inhabit sensor-instrumented environments. In such IoT-instrumented spaces, the onus of ethical decision making about what data ought to be collected or how data processing algorithms must behave necessarily shifts further onto those developing and deploying the relevant technologies and services. As occasional IoT snafus demonstrate, such as for example when an Amazon's Echo device recorded a snippet of a private conversation in a home and sent it to a random contact in its contact (Wolfson, 2018)[4], the end users of IoT technologies must trust that their devices are designed in a way that respects their owner's dignity. This suggests that we must add a notion of power to our basic definition, where ethics is values in action taken in contexts – within power relationships and constraints. In this way we incorporate the idea that ethics as a process includes the acknowledgement of responsibilities for power. We see engagement with the development of IoT

[4] Wolfson, S., 2018. Amazon's Alexa recorded private conversation and sent it to random contact. The Guardian. https://www.theguardian.com/technology/2018/may/24/amazon-alexa-recorded-conversation. Accessed 08 July 2018.

technologies and services as an occasion to examine longstanding issues of information policy in design, and to interrogate persistent ethical issues that have become newly complex in this situation. The strength of our approach lies in its inherent interdisciplinarity, which forces us as researchers to reflect upon and negotiate our own disciplinary differences in conceptions of ethics as we engage enactments of ethics by IoT developers and designers.

Such a standpoint permits us to engage with a range of different ways of thinking about ethics. Modern writing on ethical concerns with regard to technology leverages a range of different ethical approaches. By and large, however, these concerns broadly fall into two general approaches of consequentialist and utilitarian ethics and this is echoed in our in-situ ethnographic investigations where conversations with IoT developers often focus on efficiency and control as important reasons for doing IoT innovation (see Section 4 for details). Much of the ethical assessment of emerging technologies concerns the question of what is good and bad about the products, services processes that they may bring about, and what is right and wrong about ways in which these may be used (Brey, 2012)[5]. Some explorations, such as, for example, self-driving cars specifically focus on utilitarian concerns of minimizing harm and maximizing benefits for all affected, while grappling with the difficulties of how to define harm or benefit and how to identify boundaries around who ought to be included in such a calculus.[6] For example, we often see various examples of different versions of the age-old trolley problem discussed in media and in conversations with developers. The question is almost always simplified into an either/or (one person definitely needs to be killed)[7] and the ethical justifiability of killing someone is rarely questioned. Part of the problem with these approaches is their need to include both potential mundane and existential difficulties, making the rational calculus intractable and often leading to significant reductionism.

We propose to go beyond the consequentialist and utilitarian points of view, using alternative ethical approaches that we believe fit better with the problems at hand. These include virtue ethics which tend to focus on an individual's process of attempting to live a good life, capabilities approaches that examine the ability to act, including to choose an alternative given the existing structural constraints and opportunities, and care ethics which not only examine responsibility and care but take into account the shifting obligations and responsibilities of individuals as they are positioned in a web of relations. By bringing these approaches together into a coherent framework we are able to acknowledge that ethics as process is not exclusively dependent on the principles and actions of the individual but acknowledges the inherent dialectic of life where conflicting demands, obligations and structural conditions can limit and shape even the best intentions. Below we provide a short description of each of these ethical traditions and how they appear from where we are standing. Then we review how the interdisciplinary concerns of ethnography, design and legal scholarship fit together to support a broadly applicable ethical framework.

[5] Brey, P.A., 2012. Anticipating ethical issues in emerging IT. Ethics and Information Technology 14, 305–317.
[6] Thomson, J.J., 1976. Killing, letting die, and the trolley problem. The Monist 59, 204–217; Thomson, J.J., 1985. The trolley problem. The Yale Law Journal 94, 1395–1415; Singer, P., 2005. Ethics and intuitions. The Journal of Ethics 9, 331–352.
[7] Crockett, M., 2016. The trolley problem: would you kill one person to save many others? The Guardian. http://www.theguardian.com/science/head-quarters/2016/dec/12/the-trolley-problem-would-you-kill-one-person-to-save-many-others Accessed 08 July 2018.

4.1 Virtue ethics: The role of the individual

As we have detailed previously in Deliverable 2.2 (section 3.5), virtue ethics can be traced back to the philosophical writings of Plato, Aristotle, Socrates, and the Stoics. It claims that there is a kind of 'final good' which represents the desirable aims of someone's life, and against which these aims can be evaluated. All questions attached to right action are assessed against this final good - known as eudaimonia[8]. Virtue ethics tends to ask "What it is that will enable the agent to lead a life characterised by eudaimonia?" (p. 1510). Eudaimonia is attained through enacting a virtuous life which revolves around training the emotions and motivations including the rationalizations that people make for their actions, in relation to what they might think about as developing rational understandings of how to act, and focuses on building 'good character'. Therefore, virtue ethics is concerned with questions such as "What is a good life?" or, more specifically, "What does it mean to be a good person?"[9]. Contemporary virtue ethics emerges from the work of Elizabeth Anscombe[10], particularly in her foundational paper 'Modern Moral Philosophy' from 1958[11]. Anscombe wanted to refocus on Aristotle's ethics and the question of what a person of good character would do in specific ethical dilemmas. This means focusing on excellence, virtue, and eudaimonia, instead of duty, rights, and obligations, which were the typical concerns of popular consequentialist and deontological approaches. More recently Vallor[12] applied a version of virtue ethics to the problems of technology, calling for a concerted collective effort to develop "technomoral virtues" that can guide the nature and direction of technical innovation in this rapidly changing world to ensure human flourishing.

Virtue ethics offers an individualist approach that sits well with the ethos of technological development, focused as it is on augmenting and improving the self. The familiar rhetorical devices such as "technologies for good" or "don't be evil" speak to the idea that the virtuous moral choices of technology developers and designers can lead to bringing about a better life for all. From a virtue ethics point of view, such an outcome hinges on individuals actively cultivating particular virtues in themselves resulting in the kind of moral character that would lead to decisions with good outcomes. Despite this focus on the internal worlds of individuals, virtue ethics also emphasizes the importance of community. Sicart[13] notes that communities "have the responsibility of creating the implicit and afforded codes of interpretation and conduct" (p. 125) that come to define what constitutes a good life and the "right thing". Virtue ethics gives most importance to the individual as an ethical agent in their decisions and practices and as a part of a community. MacIntyre[14] calls this a social setting or a social milieu which influences the kinds of virtues that an individual may deem possible or viable as well as structures how virtues may or may not be expressed because people act not only in relation to virtues of the individual but also in various collective contexts; the relationships of 'we' as opposed to 'I'.

[8] Annas, J., 1993. The morality of happiness. Oxford University Press, New York ; Oxford.
[9] White, R.J., 2008. Radical virtues: Moral wisdom and the ethics of contemporary life. Rowman & Littlefield, Lanham, MD.
[10] Anscombe, G.E.M., 2005. Human Life, Action and Ethics, Mary Geach and Luke Gormally eds. St. Andrews Studies in Philosophy and Public Affairs. Imprint Academic, Exeter.
[11] Anscombe, G.E.M., 1958. Modern Moral Philosophy. Philosophy 33, 1–16.
[12] Vallor, S., 2016. Technology and the virtues: A philosophical guide to a future worth wanting. Oxford University Press, United States of America.
[13] Sicart, M., 2011. The ethics of computer games. MIT Press, United States of America.
[14] MacIntyre, A., 2007. After Virtue: A Study in Moral Theory, 3rd ed. University of Notre Dame Press, Notre Dame, Indiana.

MacIntyre raises a larger set of questions about the extent to which various perspectives on virtues or the 'good' can be defined and worked through. He claims that the relationship between individual responsibility and individual moral action, and the broader political and social contexts that people find themselves in, can both shape and constrain the capacity for 'practical reasoning'. These might include collective efforts to build technologies, establish standards, or establish governance frameworks may influence the exercise of what are often assumed to be individual virtues. In Macintyre's view, we are always in the process of undertaking our own, specific practical reasoning. This practical reasoning represents the priorities that we have for ourselves, and these priorities are ordered and influenced by the social contexts in which we find ourselves. Sicart points to the Aristotelian concept of phronesis - the practical wisdom that allows people to determine how to make choices that will help them further develop as virtuous beings. This is a kind of moral wisdom (MacIntyre's practical reasoning) that is developed through experience and used to engage with the actions, problems and dilemmas they encounter in practice and as members of their various communities. It is also the kind of moral wisdom that allows them to dialogically negotiate the often contradictory demands and tensions of being part of more than one community at the same time. For example, the designers who developed the IoT Design Manifesto were clearly trying to find ways to reconcile the ideals of virtuous conduct developed within their design communities with the contradictory and at times antithetical demands of the clients that pay their bills. In this way, the manifesto became a moral object used in managing such negotiations.[15]

Virtue ethics draws with significant concern on the moral action of the individual and the role of community. Such an approach also offers a methodological opportunity to justify engagement with individuals and their articulations of values and principles as a legitimate pursuit. Yet in terms of identifying values, virtue ethics presents an interesting challenge. We have identified that the social milieu of (especially commercial) IoT development provides many constraints to people's ability to act in ways that they might think of as ethical. In particular, the idea of competing in a market or being subject to market pressures provides a particular constraint, which some people talk about transcending through their own personal work or actions or through the creation of alternative organizational structures such as the Open IoT mark. Here we observe the struggles inherent in developing codifications of practice and virtue ethics recognizes that morality is always imperfectly reflected in standards and principles, not defined by them[16]. Virt-EU researchers are often greeted with enthusiasm because they are perceived as being able to help address or solve ethical issues.

Part of the difficulty with virtue ethics however, is precisely its tendency to individualize the responsibility for virtuous action even if there is a role for communities in this process. According to MacIntyre, a virtuous agent knows the correct way to act in various contexts while also desiring to act in such a way.[17] Where MacIntyre acknowledges that judgements of virtuousness can only be conducted contextually, the expectation of knowing what is the right, good or virtuous way to act in the context of technology development is problematic. If Vallor is correct in her argument that it is imperative that we,

[15] Fritsch, E., Shklovski, I., Douglas-Jones, R., 2018. Calling for a Revolution: An Analysis of IoT Manifestos, in: Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems. ACM, p. 302.
[16] Vallor, S., 2016. Technology and the virtues: A philosophical guide to a future worth wanting. Oxford University Press, United States of America.
[17] MacIntyre, A., 2007. After Virtue: A Study in Moral Theory, 3rd ed. University of Notre Dame Press, Notre Dame, Indiana.

as Western societies, must develop "new alignments of our existing moral capacities" (2016, p.10)[18] in order to productively cope with the rapidly changing world, how are the developers who are, in part, actively changing this world, supposed to leverage their existing moral capacities for good? What sort of practical reasoning or wisdom is necessary for developers to navigate the pressures and constraints of the broader economic, political and social contexts that they inhabit? Virtue ethics does not offer satisfactory answers to such questions and thus we turn to other theoretical tools to help develop and augment this framework.

4.2 Capabilities approaches: Acknowledging structural constraints and opportunities

In trying to understand how ethics manifest as values in action in the contexts of hierarchy and power, it is important to consider who chooses to follow an ethical approach, and why or why not. We have been increasingly concerned with this question as all ethical and moral stances, ultimately require individuals (or groups) to not only have certain ideals/virtues/thinking, but also choose to act in accordance with them. But what leads some individuals/groups to choose to act in a certain way and what might shape or constrain that choice of action? One important attempt to elaborate on this question has been provided by Amartya Sen in his capabilities approach[19]. Sen[20] explains that " a person's 'capability' refers to the alternative combinations of functionings that are feasible for her to achieve. Capability is thus a kind of freedom to achieve alternative functioning combinations." This means that paying to attention to individual's internal capabilities is insufficient and we must also consider the possibilities created by a combination of internal capabilities and the structural conditions defined by the particular social, economic and political environment within which the individual attempts to act.

Martha Nussbaum took Sen's capabilities framework and conceptualised it further through a grounded Aristotelian understanding of what it means to lead a good life, rooted in virtue ethics.[21] She proposed a core set of 10 human capabilities necessary for humans to lead a life with dignity and to flourish. These human capabilities ranged from being able to live without physical or mental harm to being able to recognise and show concern for other human beings to engage in various forms of human interaction and to access a wide range of artistic and aesthetic experiences through education.[22] Nussbaum's conceptual clarification helps us question one of the basic premises of Aristotelian virtue ethics that all individuals ultimately would act in accordance to virtues of their own choosing, as it theorises the idea that ethical thinking itself is also a capability and not a given for individuals. More importantly, Nussbaum clearly explains that internal capabilities (including the cultivated virtues and moral character) can only get us so far and that the structural conditions of society provide what Nussbaum calls "the avenues through which people actually have the opportunity to function in accordance with

[18] Vallor, S., 2016. Technology and the virtues: A philosophical guide to a future worth wanting. Oxford University Press, United States of America.
[19] Hesmondhalgh, D., 2017. Capitalism and the media: moral economy, well-being and capabilities. Media, Culture & Society 39, 202–218.
[20] Sen, A., 1999. Commodities and Capabilities: Amartya Sen. Oxford University Press, New York.
[21] Nussbaum, M.C., 2001. Women and human development: The capabilities approach. Cambridge University Press.
[22] Hesmondhalgh, D., 2017. Capitalism and the media: moral economy, well-being and capabilities. Media, Culture & Society 39, 202–218.

those capabilities" [23]. Thus the moral virtues of a developer may not lead to good design because of structural pressures and constraints such as the demands of the funders or the costs and availability of particular technical infrastructures.

This recognition that personal principles may need to be compromised to cope with structural constraints point to the importance of understanding what these constraints are and what influence they might exert. Furthermore, technology developers are in a curious position of both having to make decisions within the structural constraints of their context and having to acknowledge that the design decisions they make will result in producing structural constraints and possibilities for their users. Thus for developers to "do good" it is important to not only evaluate how existing constraints affect design but also to consider how these constraints are translated into the design and how these might be mitigated to offer more or different possibilities to the users.

Nussbaum offers several conceptual tools to work through such a thorny problem. First, she introduces the concept of threshold to identify what she calls "central capabilities" - the bare minimum required to ensure justice and decency. Thus while developers and designers may ideally envision technologies that operationalize many virtuous ideals, there is likely a core set of principles that is non-negotiable while the majority of virtuous ideals may need to compromise to cope with structural constraints. Identifying what such core principles are and, perhaps, interrogating what these might need to be, is an important step in thinking about ethical technologies. The compromise of these central capabilities may lead to what Nussbaum calls the situation of a "tragic choice" - where "any course we select involves doing wrong to someone." How might decisions about such trade-offs be taken, how might these be supported or guided? Most importantly, who must take on responsibility for such choices or for creating the conditions for such choices to be necessary? Arguably, the thought experiment of the trolley problem, frequently debated with respect to self-driving cars, is in fact an example of such a tragic choice and the question then is what kinds of central capabilities have been compromised to make this a potentially likely scenario. Perhaps instead of deciding whether to kill a bunch of kids or an old person we ought to consider how is it that we ended up in this situation in the first place.

The capabilities framework augments the internally oriented focus of virtue ethics on the moral capacities of the individual, by adding the importance of structural constraints. However, in both of these philosophical approaches decisions are made by individuals (even if within a social milieu) and it is individuals that must take responsibility, accounting for the constraints imposed by the broader social, political and economic contexts. Developers and designers of IoT technologies, just like everyone else, are certainly not alone in making decisions and in facing the consequences. However, in positioning the developer as a virtuous actor that must know the correct ways to act, we also position the failure to act correctly as a personal defeat, amortized as it might be by existing and recognized structural constraints. This begins to resemble what Trnka and Trundle[24] point to as an increasingly common aspect of contemporary discourse, which invokes responsibility as a virtue without "the reflexivity about its inherent social worth." They see this as a symptom of "responsibilitisation" - an increasingly common pattern of institutions and organizations shifting obligations from themselves to individuals. Yet the capabilities approach does not provide us with a language to consider obligations and virtue ethics

[23] Nussbaum, M.C., 2011. Creating capabilities. Harvard University Press; Nussbaum, M.C., 2009. Creating capabilities: The human development approach and its implementation. Hypatia, 24(3), pp.211-215.
[24] Trnka, S., Trundle, C. (Eds.), 2017. Competing Responsibilities: The Ethics and Politics of Contemporary Life. Duke University Press Books, Durham.

explicitly turns away from this concept[25]. Thus we rely on a third ethical tradition to give us the conceptual language to address this issue, that of care ethics.

4.3 Care ethics: A networked, relational point of view

In contrast to the focus on the internal individual moral character of virtue ethics, care ethics focuses on our responsibilities and obligations to others. Philosophers concerned with care ethics often begin by arguing that there is not a single standpoint for morality but that multiple positions are possible. Here a central concern of ethical consideration and action should be the capacity that we possess to care for one another. The work of creating and maintaining relationships is central to care ethics and it acknowledges that the value stemming from relational practice must be considered from different points of view. This has the consequence of allowing for considerations of the points of view of women or marginalized people who have not been part of the ethical discussion, and also for considering the ethics of practices such as caring which may have been absent from other readings. Joan Tronto[26], for example, rejects essentialisms in gender and moral thought and advocates for contingent and historically situated definitions.

One of the main claims of care ethics is the emphasis on an engaged, active agent that acknowledges that he/she is entangled in a broad web of relationships that require the constant negotiation of disparate and often conflicting demands and obligations. According to Carol Gilligan[27], ethics is less about abstracting problems and rationalising them and more about understanding the context and the relationships involved. This implies that decisions might have to challenge some ethical precepts in order to support the relationships involved. Talking and understanding, reasoned discussion rather than debate are part of the repertoire of approaches provided by care ethics. Care ethics emphasizes the possibilities and limitations of interconnection and interdependence over the ideals of individual moral character.

In our work, we are interested in the tensions between how individuals must negotiate their, at times conflicting obligations and responsibilities to others, and how they are expected to behave virtuously or ‘well’ in relation to a ideal set of future potential states of being. We have noted that responsibility to others is located in particular places within organizations, and that generalized perspectives on ‘ethics’ do not always include responsibility or ‘care’. Yet programmers and data managers also ‘care’ for code and data. How then must we consider what constitutes “doing good” given the conflicting relational demands from team members, management, other institutional arrangements, personal relationships, diverse community memberships as well as from the moral objects of hardware, data and code? These are what Puig de la Bellacasa[28] terms “matters of care” embedded in situational experiences of practice.

[25] Anscombe, G.E.M., 2005. Human Life, Action and Ethics, Mary Geach and Luke Gormally eds. St. Andrews Studies in Philosophy and Public Affairs. Imprint Academic, Exeter.
[26] Tronto, J.C., 1993. Moral boundaries: A political argument for an ethic of care. Routledge, Chapman and Hall Inc., London.
[27] Gilligan, C. (1982). In A Different Voice: Psychological Theory and Women’s Development. London: Harvard University Press.
[28] Puig de la Bellacasa, M., 2011. Matters of care in technoscience: Assembling neglected things. Social Studies of Science 41, 85–106

Care then is a kind of speculative ethics because it is in and of itself, a heterogeneous relational practice where, according to de la Bellacasa, "interdependency is a condition".[29]

Individuals are always entangled in a diversity of relations that hold contradictory values and conflicting demands. For example, collaboration is seen and acknowledged as an important 'value' among the IoT community (e.g. open access software, off-the-shelf hardware). At the same time, for many startups, the pressures of 'making it' in the ever more competitive IoT market push people to focus on 'survival' thus privileging some collaborative relations over others and perhaps even eschewing relations that previously held significant sway. Thus many startups might begin with active participation in the open hardware or open source communities, but then move towards black-boxing their solutions in an effort to convince investors of their financial viability. This often results in significant damage to their reputation and relationships within the open sources communities and can lead to internal conflicts and even dissent. Care ethics give us a situated theoretical framework to examine the relations that weave ethics and values within the decisions of some developers; and how those values emerge and are sustained. They also help us trail dissent within the field of IoT, by turning our gaze to those who adopt particular ethical stances that are not always shared.

Where virtue ethics and the capabilities approach turn our gaze towards developers and their practices in general, Annemarie Mol[30] offers us a set of concepts to focus specifically on the practice of design itself and on the products and services that are created as a result. Mol distinguishes the 'logic of care' (freedom to) and the 'logic of choice' (freedom from). In a world where autonomy is considered one of the highest ideals, rhetoric around technological innovation in general and IoT specifically often leverages concepts of augmentation of individual agency, empowerment and convenience as markers of success and goodness. Yet agency is a fundamentally individualistic notion that often does not take into account the distributed social context of obligations and commitments. As Laidlaw argues, "an augmentation to one's agency is not necessarily an empowering or liberating experience." (p. 162)[31]. Instead an augmentation of agency can mean that greater amounts of responsibility are shifted on individual shoulders and the supporting infrastructures of society are increasingly dismantled, where the inability to perform becomes a personal problem rather than a socially and collectively managed issue. This is what Trnka and Trundle[32] term responsibilisation and what Mol explains as the logic of choice. Within the system of market forces, consumers make individual choices and take responsibility for these choices. As Mol puts it: "People may (or, in some versions of this logic, are required to) exercise their own judgement. The autonomy that (competent) individuals are entitled to within the logic of choice is precisely the autonomy of attaching their own value to just about everything (except autonomy).[33] In the logic of choice making normative judgements is the moral activity par excellence, and it is this activity that this logic endorses.".[34] For example, people who complain about the way their data are treated by

[29] Puig de La Bellacasa, M., 2017. *Matters of Care. Speculative Ethics in More Than Human Worlds*. University of Minessota Press. p. 70

[30] Mol, A., 2008. The Logic of Care: Health and the Problem of Patient Choice, 1 edition. ed. Routledge, London ; New York.

[31] Laidlaw, J., 2013. The Subject of Virtue: An Anthropology of Ethics and Freedom. Cambridge University Press, New York.

[32] Trnka, S., Trundle, C. (Eds.), 2017. Competing Responsibilities: The Ethics and Politics of Contemporary Life. Duke University Press Books, Durham.

[33] Mol, A., 2008. The Logic of Care: Health and the Problem of Patient Choice, 1 edition. ed. Routledge, London ; New York.

[34] Ibid, p.74.

the technologies they use are often told that they have made their own choices by choosing to use these technologies and thus ought to take responsibility for the results.

The logic of choice justifies the incessant use of consent forms for every aspect of data collection because it becomes a way for the developers to eschew responsibility and to offer the ostensible choice of whether or not to disclose personal data to the user. The user, in turn, is left to make this decision on their own thus agreeing to take responsibility for whatever outcomes occur. The developer in this case can claim that their decisions about data are not moral choices, because these choices are made explicitly by the consumer and there is no obligation to use the technology. Mol argues that from the point of view of the logic of care, this becomes a vast oversimplification. Technologies are, of course not neutral. They embody and reflect the ethics and morals of their creators and, as Mol argues: "since they are made to contribute to improving lives, they incorporate some notion of what counts as an 'improvement'. What is more: innovations tend to be morally complex."[35]

The logic of care then encompasses the morality of action through practical activity. According to the logic of care "It is important to do good, to make life better than it would otherwise have been. But what it is to do good, what leads to a better life, is not given before the act. It has to be established along the way."[36] While this sounds similar to MacIntyre's conception of virtue ethics where evaluations of virtuousness can only be derived as a contextual practice, there are crucial differences. In the logic of care there is no expectation that everyone ought to be figuring this out for themselves, separately from others. In fact, individuals are never making their decisions alone, but that does not mean that social entanglements with others are necessarily always positive. Relational work, after all, is work with uncertain outcomes. Instead of conceptualizing actors as separate individuals that happen to form communities or other social arrangements, the logic of care forces us to acknowledge that we are never separate individuals, but are composed of our many memberships, relations and social entanglements that span life.

The logic of care does not presume to completely supplant the logic of choice, nor to claim that within the logic of care no choices are made. Rather, this approach offers an alternative lens on the responsibilities and entanglements designers and developers must navigate. If designers and developers of IoT technologies are guided by the logic of choice to produce products and services that often responsibilise their users, an interrogation of this from a virtue ethics or the capabilities perspectives deals in terms of responsibilities. Those responsible for the design choices are then guilty of their outcomes. Care ethics offers us a way to pivot from guilt as a result of prevailing rhetoric guiding design choices. The logic of care has no real use for guilt, because it merely calls for acknowledging problems and trying again. In this way, the logic of care offers a way around the paralyzing realizations of downright apocalyptic possibilities of IoT that we have previously observed in our analysis of IoT manifestos.[37] Where might we seek solutions to these problems? Cohen[38] proposes the idea of "semantic discontinuity" as the opposite of seamlessness - a call for strategically under-designing technologies in order to allow spaces for experimentation and play. Such intentional building in of flexibility may be one way to offer possibilities for alternatives.

[35] Ibid, p. 77.
[36] Ibid, p. 75.
[37] Fritsch, et al., 2018
[38] Cohen, J.E., 2012. Configuring the networked self: Law, code, and the play of everyday practice. Yale University Press, New Haven and London.

4.4 Relation to legal approaches

Alongside the extensive treatment of ethical approaches, the VIRT-EU project also employs legal approaches to consider the role of ethics by relying on the common ethical values recognised by international charters of human rights and fundamental freedoms. Legal requirement and mandates seek to balance the interests of the data subject and other stakeholders involved in the development and provision of products and services. The current legal context around technology development has been heavily focused on data protection through the implementation of the General Data Protection Regulation (GDPR).[39] As is explained in Section 5 of this report, the Privacy, Ethical and Social Impact Assessment model developed by VIRT-EU seeks to go beyond the legal bounds acknowledging there are many instances where legality of activities does not necessarily mean these are ethically or socially sound. Rapid changes introduced by technological innovation have resulted in a multitude of ethical challenges that are not addressed by the law.

In turning back to the ethical framework presented above, we may draw parallels between the opportunities and constraints imposed by the existing regulatory context in Europe and the capabilities framework which explicitly acknowledges the importance of these strictures. Going further, the principle of informational self-determination that underpins many aspects of the GDPR is an exemplar of a logic of choice, where decisions and their consequences are the responsibility of the autonomous individual. At the same time, the principle of proportionality requires considerations not only of the particular structural constraints but also of the relations involved in any particular situation. Where notions of fairness, transparency and autonomy speak directly to the moral character in virtue ethics, the addition of the concept of accountability as a common legal frame, shifts the discussion again towards ideas of care. In this way, the ethical framework provides a usable set of concepts to engage with the legal frames of the projects.

4.5 A framework for design

The ethical framework developed and discussed above, combining virtue, care and capabilities approaches in dialogue with legal requirements, provides an interpretive lens for understanding how and why designers and developers make decisions and do what they do. The rhetoric of technological innovation often privileges individual principles and virtues as primary drivers for generating change. While such rhetoric aligns with the principles of virtue ethics, additions of care ethics and capabilities approaches allows us to take into account the structural constraints, responsibilities and obligations that designers and developers have to work with. Such a framework provides a basis for designing tools to help developers consider the ethical concerns and implications of their practices.

[39] European Parliament and of the Council. 27 April 2016. Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) (Text with EEA relevance)

5 IoT in developer & design practice

Task 3.3 (Community of practice studies) – to complete in M21

Having developed a practical framework for ethics, we then consider how these ideas fit with the ethnographic and design research that we have conducted to date. In the following sections we consider what are the problems articulated in the practices of IoT and what seem to be the embedded assumptions? How does ethics surface as values in action and what contexts of power and responsibility are considered? How is reasoning done and how are responsibilities assigned or taken on? What is assumed as a necessary evil and what seem to be points of concern? In the course of the prior eight months we have conducted in-depth ethnographic research in two locations and three field sites. As detailed in Deliverable 2.2, we have selected two geographical locations for in-depth inquiry based on extended domain analysis conducted during the first year of the project.

Our first geographical location is London and it contains several distinct field sites. We decided on London as a fieldsite at the outset of the project because London emerged as an important, extremely active and central location for IoT development and innovation. We confirmed this with the quantitative analysis of both Twitter and MeetUp date. The London team continues to focus on the collective contexts in which IoT products are developed and where, in particular, IoT designers and developers meet each other and discuss issues of shared concern. In particular, they have focused on IoT meetups, co-working spaces that house many hardware-related startups as well as engaged directly with other relevant actors in this space.

Where London has a strong concentration of mainstream IoT innovation efforts, our second geographical location is Amsterdam, selected as a geographical region with a curious concentration of alternative perspectives on IoT development. Here we observe many efforts to debate, interrogate and innovate with an eye to the particular ethical quandaries that IoT development can bring. Despite its relatively small size in numbers in comparison to London for example, Amsterdam is home to many distinct efforts to rethink IoT from hardware, software, design and engineering angles. For example, the region has originated at least three IoT manifestos in the last few years[40] coming from different groups and proposing different goals and values.

The London team located at LSE also engaged with a border-spanning field site of the IoT Trust Mark development, following the ground-up developer and designer-driven process of the creation of an IoT standard with very particular ethical concerns underlying it. Although this effort originated in London, it has since moved between London and Berlin, engaging with actors from across Europe. The IoT Trust Mark is an effort that is not only distinctly ethical but also one that is attempting to bring alternative perspectives on IoT into direct conversation with mainstream efforts within the IoT innovation environment.

Alongside these concentrated ethnographic efforts, we have also spent some time exploring much smaller and less dynamic IoT development environments such as Copenhagen, Denmark and Malmo, Sweden in order to compare the kinds of concerns and questions that emerge here with those that are under discussion in highly active and dynamic environments.

[40] Fritsch, E., Shklovski, I., Douglas-Jones, R., 2018. Calling for a Revolution: An Analysis of IoT Manifestos, in: Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems. ACM, p. 302.

In the sections below we detail the initial insights from ethnographic engagements in these field sites. We begin with reports from London, summarizing research in MeetUps as well as presenting initial notes from the IoT TrustMark research. We then present a number of insights and initial findings from our work over the last six months in Amsterdam. Finally, we detail the kinds of concerns we observed in Copenhagen and Malmo. At the end of this section, we present results from initial co-design workshops in Amsterdam and London that have allowed us to consider possibilities of engagement and perhaps even intervention from a practical point of view.

5.1 Reports from London

5.1.1 Research Sites and Research Foci

Task 3.3 – UK field sites – on-going to complete in M21

The London-based team has been continuing to develop a research approach that focuses on the collective contexts in which IoT products are developed and where, in particular, IoT designers and developers meet each other and discuss issues of shared concern including ethical issues. Our current field sites include:

- London IoT MeetUps - building on the work began in the first project phase and described in deliverable 2.2 we continued to attend MeetUps and also began to visit other group meetings and locations where ethical issues are discussed, including the Women of Wearables Network and other IoT locations
- Open IoT mark development - we are continuing participatory fieldwork on the development of this mark, which is a "community led effort to make a free, accessible, open checklist aimed at startups and SMEs to help them design better connected products."[41]

In parallel we have been building on our fieldwork to develop some reflections on the way that *materiality* operates in ethical considerations, and to create a conceptual understanding of how ethics might be understood.

From Values to Things

One of the most common approaches to the study of ethics and technology is by exploring the role of normative values in the process of development. However, at the LSE we have decided to introduce a different way of posing the problem that can provide a new fruitful source of analysis. Researchers and scholars from the field of Studies of Science and Technology (STS) such as Bruno Latour claim that 'objects' or 'things' can also shape how developers think about values.[42] In this way, morality is not only 'inscribed' in technological devices, but technological devices themselves can shape how developers think about ethics.

For instance, choosing a network to transmit IoT data demands important decisions from the side of the developer, and the available options can spark specific ethical reasoning. In practical terms, this approach implies that instead of proposing a list of 'values' shared by the IoT community (Deliverable

[41] https://iotmark.wordpress.com last accessed June 15, 2018
[42] Latour, B., 2005. From realpolitik to dingpolitik, in: Making Things Public: Atmospheres of Democracy. MIT Press, Cambridge, M.A., pp. 14–43.

2.2), we lay out a set of technical configurations that pose special constraints and opportunities for IoT entrepreneurs and some of the ways they have addressed them.

This approach has two main advantages. The first one is that it challenges the excessive focus on 'data' that is usually the first issue that IoT developers explicitly acknowledge as 'ethical'. Instead, when analysed from the perspective of technical configurations, it is possible to find multiple possibilities and constraints triggering what Swiestra and Rip[43] understand as 'ethics': a situation where usual answers to dilemmas are put into doubt and what is faced is a terrain of uncertainties, arguments, and discussion.

The second advantage of this approach is that it expands the 'places' where ethics take place. Since ethics is not only driven by thoughts and ideas, it becomes necessary to look at different aspects of technological development. Now not only the 'mind' or the 'head' is the space of ethical disputes, but also a broad range of practices that involve embodied actions and everyday routine and interactions, among other elements. In addition, the agents of these practices are now not only human actors but also technologies themselves. During the next phase of our research we will rely on this approach in our fieldwork, giving participant observation an important role for understanding how IoT ethics operate *in practice*.

The following list was developed through a light level of analysis of field notes collected in the course of the prior 18 months and presents examples that form the basis of the new empirical approach. Here, we sought to highlight moments where a material property would become an ethical issue, presenting specific challenges for developers. We finally classified them into five broad categories attending to the types of challenges posed.

Data

'Data' is the main idea that is brought up by developers when they are asked about ethics (observation, March 1, 2017). In material terms, what is known as 'big data' — the rapidly increasing size, diversity and rates of production of digital data — introduces several challenges for developers, making it difficult to make sense of what information is actually being collected or what details could be guessed from existing databases. As a developer affirms, IoT entrepreneurs simply "don't understand their data" (observation, January 30, 2018). IoT is first and foremost a data-driven set of technologies and understanding how and why data might be implicated is crucial for any sort of decision making. See the discussion of data ownership in section 3.3 below.

One of the most common ways in which entrepreneurs and managers seek to avoid this issue is by focusing on data ownership and claiming that all information collected would belong to users (observation, 26 March, 2017). This response draws on neoliberal common-sense assumptions of the market as regulator, avoiding ethical questions such as why are those data being collected in the first place. More post-GDPR field work is needed here, but the recent introduction of the new regulation might change this scenario. As an IoT developer affirms, "post-GDPR, people have to work out whether or not they need all of that data to make money, and what data they need to make money, and what data they need to protect" (interview, 27 April, 2018).

[43] Swierstra, T., Rip, A., 2007. Nano-ethics as NEST-ethics: patterns of moral argumentation about new and emerging science and technology. Nanoethics 1, 3–20.

Networks, standards and protocols

One of the most important aspects of IoT is its reliance on 'machine-to-machine communication'. This seemingly simple aspect of the technology demands serious agreements from the IoT community regarding what information is going to be transmitted, how and through what medium. Network protocols are often governed by a proliferation of standards many of which are constantly revised to fit the changing technical context. Standards may often be seen as technical decisions, but they have important social implications such as the inclusion or exclusion of users or the privilege of certain types of behaviour. Institutions such as the British Standards Institute's Consumer and Public Interest Network is seeking to develop consumer privacy standards applicable to IoT because, as they see it, while laws are relatively vague, standards can provide clear and straightforward guidelines for behavior (observation, June 13, 2017). In many ways, the search for standards is a search for guides to what "good behavior" might constitute in the IoT context. See a discussion of standards and their ethical implications in section 4.3.

Similar to observations from Amsterdam (section 4.2), the area of networks provides an interesting topic of research given the proliferation of alternatives to the mainstream internet protocols. Emerging options in Europe such as LoRa, Sigfox and NB-IoT try to gain purchase not only by providing alternative technical infrastructures for managing IoT connectivity specifically, but also by appealing to different values. Another approach to this problem has been to simply partition and bound local networks and the broader internet connectivity using the same protocols but a different logic for connectivity governance. For example, according to the private IoT cloud platform Soracom, the public internet consumes too much energy, and 'intranets of things' could be a better solution (observation, February 27, 2017). A similar idea drove Dyne.org (Section 4.2) to create their DOWSE device which seeks to increase awareness by making visible the networked nature of IoT. In this way creators of Dowse and similar devices employ strategic moral reasoning to manage the potentially negative implications of IoT innovation (Section 4.2) that we have previously identified in our analysis of IoT manifestos.[44]

After an initial basic analysis of several IoT Meetups in the UK and Amsterdam (Section 4.2) we noted that the choice of specific networks in IoT is an occasion for community bonding and a source of identity for developers. The programming language employed can also be understood as a membership for specific communities. This is the case of Android Things, which, according to one of its supporters, does not only have several technical advantages but also a big community where one can ask questions and contribute (observation, March 20, 2018). Big companies are also offering alternatives for IoT networks, offering higher levels of security through products such as Bluetooth Mesh Networking.

Marks and certifications always have a clear ethical orientation (such as the Open IoT Certification Mark, see below) and involve ethical decisions. For instance, a website of a commercial certification option advocates that "By participating in the Mbed Enabled Program, you are helping to make Internet of Things (IoT) devices that are secure, energy efficient and based on open-standards".

Hardware

What distinguishes IoT is that it precisely seeks to connect *things*. The physical components employed by developers imply specific challenges. A typical issue in relation to hardware are *chips*, where choices not only have an impact on costs and price but also on different levels of security (observation, May 28,

[44] Fritsch et al., 2018

2017). Chips can be more or less reliable, but here the decisions of entrepreneurs are often constrained by their budgets. From a security point of view - an significant issue for IoT devices and services - chips are relevant because the same model can be employed by completely different devices, so if someone hacks a smart teapot, the same vulnerability can be exploited in a smart health device (observation, February 27, 2018). There is a concern in the European IoT community for the massive use of unreliable low-quality chips imported from China.

Other elements discussed here such as energy can also be understood as 'hardware'. However, it is important to include this category so other hardware-related elements can appear.

Energy & Environment

Energy and its relationship to environment plays a fundamental role in IoT because of two main reasons. First, many IoT devices rely on low-powered sensors and hardware which consume less energy. Second, many IoT products are made with cheap plastics and are not designed for maintenance or repair, resulting in a significant adverse impact on the global environment.

In relation to the first point, there are currently some initiatives seeking to find new sources of energy for small devices. Blaze is a good example of this. They are famous as providers of the laser lights that are employed by London's Santander Cycles, but they nonetheless self-identify as "experts in getting power from dynamos" (observation, January 30). Also, this issue is present in initiatives not directly focused on IoT but that might have an impact on it. For instance, Chargrifi seeks to bring Wi-Fi to public venues (observation, February 26, 2017) thus potentially enabling IoT services in these venues. Finally, a common way of saving energy is by employing IoT-efficient networks via low-powered hardware.

The second reason why energy plays an important role is for environmental reasons. A common concern here is that the massive productions of devices fueled by the IoT can damage the planet by generating excessive waste of electronic products. However, this is rarely a shared concern. Many developers argue that what IoT does is contribute by providing smarter and more efficient tools, as is the case of 'smart' buildings that can reduce the usage of energy and water (interview, 27 April, 2018). Thus the tradeoff between increases in electronic waste and savings in the use of energy and water is acceptable.

Maintenance and Repair

According to developers, a big part of IoT's business model relies on the relationship that is built with the user. Maintenance and repair become relevant elements since they provide the technical support of this long-term relationship.

Issues discussed by developers range from creators abandoning their products to the emerging trend of predictive maintenance. Neglecting the care needed by IoT devices might bring environmental issues, significantly reduce their security, and break a contract established with the user (observation, June 13, 2017). Automated maintenance can improve security and efficiency, but it also has ethical trade-offs since it can even become a rationale in itself to insist on connecting devices to the Internet. This is the case of a developer who was installing a smart system in his house and was recommended to use Google Things, so the software could be automatically upgraded (observation, March 20). A growing trend is predictive maintenance, which could eventually be used by public biking systems (observation, January 30).

Interfaces

Finally, the type of interface used is relevant because it mediates between the IoT developer, the device itself and the final user. This process of mediation is not neutral, and different configurations can have important consequences for the cost of production, the reception by users and the life expectancy of the device.

For instance, during a London IoT Meetup a foreigner living in the UK complained about voice assistants that could not recognise accents, a concern that seemed to be shared by the audience (observation, December 8). But there are also innovative ways of understanding interfaces that might challenge the traditional logic of IoT. For instance, U-smart toys seeks to develop touch interfaces that could be integrated with children's outdoor activities (observation, 26 February 2017).

This list constitutes a framework for further analysis, and will be completed with stories and observations made in the fieldwork during the remainder of this year. It is possible to establish several connections between these elements and the values discussed in Deliverable 2.2., which will be considered in the production of the VIRT-EU tools.

IoT Mark

In our observations of the IoT mark development process, we have observed some cultural aspects to the ways that IoT development is described and practiced, and have identified how these shape the ethical actions that are possible.

Norms of the social milieu continue to have a constraining effect, and there is a process through which the kinds of 'top down' ethical frameworks, as categorical principles, are refined in relation to the specific social milieu. Technical communities of practice often exhibit an 'operational pragmatism' where 'what works' and 'what is good' become conflated. In the first year of the IoT mark development process this was evident in the language through which justifications for inclusions and exclusions on the mark were negotiated: use of the 'RFC language' inherited from the early development of the internet, and software engineering principles that were understood by a small number of confident but not necessarily representative actors. In later fieldwork this also came through in relation to the process of continually making changes to the principles using new technical justifications. It is possible to see operational pragmatics as a moral frame that constrains ethics, since it renders moral action as value through justificatory regimes[45] that enfold technical function and moral goodness. This rhetorical and technological concatenation is culturally specific to a relatively narrow (yet incredibly influential[46] technical culture. This specific subculture might also be understood as an occupational identity, and in our fieldwork we saw tensions emerging between attempts to define features of an 'IoT mark' in relation to particular technical features considered 'good' such as the inclusion of APIs for allowing connection of third-party devices to networks, defining highly specific security requirements for all existing and future IoTs including precise TLSc, salted bcrypt/srcypt, NoSQL/SQL and SMB port settings and interoperability requirements through set protocols (e.g. CoAP, MQTT) and data formats (e.g. binary encoding). Operational pragmatics, viewed in this way, are a justificatory regime that both legitimates

[45] Boltanski, L., Chiapello, E., 2005. The new spirit of capitalism. International Journal of Politics, Culture, and Society 18, 161–188.

[46] see Streeter, 2011 on romantic capitalism in Silicon Valley: Streeter, T., 2011. The Net Effect: Romanticism, Capitalism, and the Internet. NYU Press, New York ; London.

broader dynamics underpinning how decisions are made and in some cases may constrain the ability of people (IoT developers) to consider broader ethical perspectives, and reiterates narrow moral orders like the one that reduces 'goodness' to 'function' and makes it difficult to consider other forms of goodness. These examples who how regimes of justification operate to shape the terrain on which it is possible to imagine ethics.

5.1.2 Future Research Plans and Directions

Technology (and IoT) for Good emerged as a potential conceptual framework for the next stage of ethnography especially because of its interest and promise of 'goodness'. From accelerators that fund only IoT companies with a particular interest in doing good to co-working spaces, industrial conferences and meetup groups entirely built around the premise of doing good in the tech world, IoT for Good is emerging as a field. For instance, Bethnal Green Ventures, a venture capital firm based in East London has grown into a massive fund and accelerator programme in less than a decade. Among their principles, they stress the importance of being responsible along with caring about the social and environmental problems and bringing in technology for better and more scalable solutions. Similarly, Tech for Good (London) meetup group has more than 7k active members, including several key figures from the IoT space.

In the next stage of fieldwork, we will be focusing on IoT for Good - as a premise and as a promise. When is an IoT good? Who are the actors that engage in IoT for Good, and why? How is 'goodness' sustained in various stages of developing an IoT product? How are the ethical challenges that impact most IoT products discussed and acted upon by those actors that work on the premise of IoT for Good? And most importantly, we will seek to understand what sort of ethics 'goodness' implies.

For this part of the London fieldwork, we are looking for co-working spaces where companies with a focus on IoT for good are located, as well as gaining access to the Bethnal Green Ventures, WearACast UK and other individuals and companies that present themselves as 'disrupting the IoT space' (observation, 13 June 2018) through their alternative ways of doing things.

5.2 Reports from Amsterdam

5.2.1 Desk work and the emergence of Amsterdam as a fieldsite

Task 3.3 – Amsterdam field site – on-going to complete in M21

During the first year, the VIRT-EU project's ethnographic teams (ITU; LSE) sought to map out what IoT development in Europe currently looks like through a range of qualitative fieldwork engagements such as attending relevant IoT events across Europe (reported in Deliverable 2.2, Section 3.0).

In the course of this work we noticed a proliferation of manifestos among IoT developers and analysed 28 of these documents to localize what kinds of values and concerns circulate among Europe based IoT developers at this point in time. In addition to gaining insights into a number of concerns expressed by different IoT developers in Europe related to the development of IoT technologies such as issues of privacy, control, (in)visibility, sustainability,

openness and responsibility[47], the manifesto analysis guided the choice of field site for a three month in depth ethnographic fieldwork.

We noticed that a significant number of manifesto authors were based in Amsterdam and the Netherlands more broadly which pointed to Amsterdam as the European city that is important to critical engagements within different communities involved with IoT development in diverse ways. As a continuation of the ethnographic qualitative work conducted throughout the first year of the project we selected Amsterdam and the Netherlands more broadly as an important site for an ethnographic qualitative inquiry into exploring more in depth what is ethically at stake among Europe based IoT developers. Following on from this, PhD student in VIRT-EU Ester Fritsch (ITU) conducted fieldwork in Amsterdam January-April 2018 by participating in different IoT related events and meetups along with spending time with, talking to, learning from and interviewing a variety of actors critically involved with IoT development.

5.2.2 A European moment of IoT Ethics

As pointed to in our manifesto analysis, the recent proliferation of these documents marks the present as a particular moment in time where concerns about IoT development have become urgent. A point in time which our fieldwork efforts tap directly into. Two larger events in the Netherlands during the period January-April 2018 together with the manifestos mark this crucial moment in time for reflecting upon the ethical possibilities and concerns that IoT technologies engender and underline how the Netherlands currently house and intensity of critical involvements with IoT.

- "Ethics of The Internet of Things" March 14 2018 . Jointly organized by the UNESCO World Commision on the Ethics of Science and Technology (COMEST) and the Department of Philosophy of the University of Twente, this took place in the University's DesignLab. This event was an effort to create a space for diverse voices embracing academics and practitioners manifesting what kinds of ethical challenges IoT technologies engender with the aim of summing inputs up in a forthcoming report on ethics and IoT. Issues that came up during this workshop were especially questions of surveillance and environmental impact both in regards to positive and negative scenarios of the IoT futures currently being developed.
- IoT Day(s) in Rotterdam April 9-10 2018. Since its introduction by the IoT Council in 2010 IoT Day is an annual event. IoT "requires innovation, experiment, research and debate" as stated in the IoT Day Rotterdam invitation[48], yet again striking the importance of debating what IoT development currently looks like, creating a sphere for sharing insights and concerns during two days of workshops, presentations and informal lunch discussions.

As we have noted during the first year of the project, in addition to these larger events smaller and more frequent meetups sprout and create spaces for developers to share dreams and dreads tied to their IoT creations. These include ThingsCon Salons, running since April 1st 2016 with the first salon taking place in Amsterdam initiating a wave of salons across Europe in Rotterdam, Eindhoven, Antwerp, Berlin, Cologne and more, including one salon organized by the VIRT-EU ITU team in Copenhagen during Techfest September 2017. In parallel, monthly Sensemakers meetups take place in changing Amsterdam venues where IoT development projects are presented and discussed.

[47]Fritsch et al., 2018.
[48] http://iotrotterdam.nl/english/ last accessed June 27, 2018

Ethnographic fieldwork in Amsterdam explore ethics and IoT development by attending to critical engagements with IoT technologies among a range of actors based in Amsterdam and The Netherlands more broadly. In addition to participating in the aforementioned events and meetups, fieldwork involved visits to diverse development sites from basements to rooftops in Amsterdam and Rotterdam. In addition to a range of field visits offering opportunities for observation, conversation, interviews and participation in the events and meetups mentioned above, this fieldwork has included activities such as attending a 'Democracy by Design' meetup, a Python meetup, and a field excursion to visit Constant's New Babylon exhibition at the Gemeentemuseum in Den Hague.

5.2.3 Insights: Critical Engagements with IoT in Amsterdam and the Netherlands

Overall, from different points of departure and through diverse engagements many actors based in Amsterdam or elsewhere in the Netherlands critique IoT. They do so through their work to highlight ethical issues in IoT development more broadly. Below we present six key examples of the variety of concerns and values ethically at stake in IoT development coming out of fieldwork in Amsterdam.

Dyne and the cultivation of transparency

One very prominent voice and initiative illuminating some of the potentially dark sides of IoT development is Dyne.org. Founded in 2000, Dyne.org is "committed to research and development of free and open source software and services"[49]. Their offices are situated in an Amsterdam harbour zone, and Dyne.org has developed Dowse, a "box" that one can setup on a low cost computer (e.g. a Raspberry-pi) and view network activity, as well as control it, visualise it, sense it and experiment with it in multiple ways. Dowse offers network awareness in "the age of the internet of things" where networks host the connectivity of many different devices owned by multiple people[50]. By allowing the end user to sense the activity of their network Dowse attends to some of the ethical challenges related to IoT development such as invisibility and lack of transparency.

Values embedded in technologies

Central insights already gained during the first year of VIRT-EU and strengthened during fieldwork relate to how IoT technologies are inevitably composed of many elements – networks, hardware, software, sensors, actuators - and that disparate values are embedded in each of the respective options that developers choose between as they develop an IoT device. One network particularly designed for IoT was launched in Amsterdam in 2015. Using a technology called LoRaWAN, The Things Network - with offices in Amsterdam placed just a few minutes by foot from the Dyne.org office - has with the development and the introduction of the LoRa network aimed at developing a "fully distributed Internet of Things Data Infrastructure" that "allows things to talk to the internet without 3G or WiFi."[51] LoRa is often compared to the network Sigfox developed in France as these are two widespread networks in IoT development entailing different values. At a Sensemakers meetup in Amsterdam March 21 2018, three networks were compared: LoRa, Sigfox and NB-IoT and it becomes clear that they all entail different ethical considerations and choices for IoT developers to make including energy usage, bandwidth,

[49] https://www.dyne.org/mission/last accessed June 27, 2018
[50] Dowse Whitepaper Version 1.2 2017: https://files.dyne.org/dowse/dowse_whitepaper.pdf last accessed July 13, 2018
[51] https://www.thethingsnetwork.org last accessed June 27, 2018

questions of ownership (e.g. of the network itself or the data travelling through the network), insurance of messages arriving in case of a breakdown and many others. Where Sigfox appeared as the most widespread network among IoT developers based in France when we attended the SIDO conference in Lyon in April 5-6 2017, LoRa appeared to be a central network among actors involved with IoT development in Amsterdam. Questions of reliability and responsibility come to the fore in the comparisons between LoRa and Sigfox.

Citizen Involvement in IoT

Citizen engagement and involvement is a central theme for ethical consideration in IoT development. At Amsterdam based tech meetups such as as the *Sensemakers DIY – Do-It-Yourself Sensing in the City*, a community embracing citizens as developers is cultivated. This is visible through IoT development projects involving citizen engagement presented at these meetups, such as the project *Airdust* or the project *Marineterrein.* These projects invite citizens to participate in measuring (respectively) firework traces in the wake of new years' eve or levels of water quality. *Waag Society* is a community placed centrally in Amsterdam especially attending to the importance of inviting citizens to participate in technological development through IoT projects. One developer, nevertheless, pointed to the potentially scary side of involving citizens as IoT developers: as even developers with a high level of expertise working with IoT struggle to create IoT technologies that are secure, then what can the citizen risk doing?

Designing for environments

The citizen is not the only central theme for ethical consideration in IoT development in regards to involvement in IoT creation processes. Among especially designers developing IoT devices, attending to the context developers design connective devices for and the users in these spaces is of crucial importance. Intervening in spaces, the lives of people and their behavior carry different ethical considerations. Getting a sense of why and how developers may intervene in a situation through technologies they introduce into the world became an overarching ethical theme for discussion in the development process where topics included the affective sensations developers set loose in the world when they seek to change the behavior of people. For instance a discussion evolved around the ethical implications of respectively designing for "attraction" or "avoidance" when seeking to move masses of people around. These considerations also tie into bigger concerns about what kind of world is being created with the introduction of new connective devices.

Hardware

Ethical considerations also circulate around hardware, a theme otherwise commonly moving very much in the background of what a range of IoT developers encountered in Amsterdam and the Netherlands more broadly pointed to as they tried to articulate what ethics and IoT might be about. Or as the IoT development company TWTG based in Rotterdam put in on their webpage: "we focus our attention on IoT-connected hardware. Someone has to, right?". Ethical matters tied to hardware involve securing a long life-time of products and considering the energy sources deployed for keeping them up and running.

Observing Manifestos in use

A theme running across all sites is the client as a very sensitive topic presenting significant constraints in relation to ethical development ideals as IoT devices come into being. Several manifesto authors expressed how they used their manifestos as a negotiation tools when meeting up with clients. Some IoT developers, on the other hand, described how they might support a lot of values expressed in the

manifestos, but do not wish to sign them as this will send signals that might scare clients away. In addition, sensitivities directed towards clients clearly manifested in processes of negotiating fieldwork access and issues of consent, as the client appears as figure companies move carefully around. Hence, the developer-client relation poses significant ethical challenges. As one developer from a small design company expressed during a ThingsCon conference in Amsterdam Now-Dec 2017: please don't create another card-game tool. Create a tool that allows us to negotiate with clients.

Directions for future work

Analysis based on Amsterdam fieldwork will proceed through attention to four major themes tied to ethics and IoT development that warrant further exploration. First, following on from the ethnographic qualitative work done so far in the project - not least the proliferation of meetups, event and manifestos -, ongoing attention will be paid to what characterises this moment in time: what shape does reflection and critique take among IoT developers or actors involved with IoT development in Europe right now? How does a sense of uncertainty and a need for action and allocation of responsibility travel? What characterises the ethical practices of initiating meetups, writing manifestos or creating an IoT Trustmark? These questions work across sites where especially developers based in Amsterdam and London will be in focus though this analysis touches upon many countries in Europe.

A second theme to be further explored emerged from fieldwork in Amsterdam and came to the fore at the UNESCO supported "Ethics of the Internet of Things" event, which took place at the University of Twente. During this event many speakers pointed to EU reports and documents written to meet the new ethical challenges of technological development. This opens up for that while ethics is enacted through meetups and manifestos in different European sites, ethics is also enacted in official EU publications. What overlaps and differences in tonality, political agendas and aesthetics characterise these diverse enactments of ethics?

A third theme to be analytically pursued post fieldwork in Amsterdam seeks to understand the approachment of (IoT) invisibilities as an ethical practice. What kinds of ethical sensitivities are cultivated by making data visible or creating devices that visualise data flows? And what kinds of ethics and values are enacted in the very software itself?

A fourth theme attracting analytical attention and to be further investigated opens up for how ethics is practised beyond the human. By this, we mean that ethical issues emerge in the ways IoT developers– or actors critically involved with IoT development–create their provocative software, alternative networks or IoT devices. While several IoT communities, meetups or events highlight the importance of moving "toward a human-centered and responsible Internet of Things"[52] or of "humanizing IoT"[53], ethical questions reach beyond the human in new ways that call for not merely philosophical debates, but also close ethnographic examples, descriptions and analysis. Central to these enquires are the material entanglements in the daily practices of IoT developers. In these everyday development settings, values are materially translated, and where materialities and codes translate into new values as IoT technologies are being developed (as the London ethnographic team has also noted in Section 4.1).

[52] https://www.thingscon.com/ last accessed June 29, 2018
[53] http://iotrotterdam.nl/programma-iot/ last accessed June 29, 2018

All of these insights from fieldwork in Amsterdam and the Netherlands more broadly entail important points of attention and themes to address in the project tool development.

5.3 Smaller inquiries (CPH and Malmo)

Task 3.3 – other field sites – on-going to complete in M21

As part of fieldwork efforts, we spent some time engaging with less active IoT innovation environments such as for example the relatively small hardware community in the city of Copenhagen where startups and consultancies work together with established institutions such as the engineering labor union, the city of Copenhagen and the Copenhagen center for Design and Architecture. The reasoning behind this effort was two-fold. First, we intended to get a sense of what issues and questions do IoT designers and developers in such smaller and less dynamic environments face in order to ensure that we are not overlooking common concerns through our focus on highly dynamic and active spaces such as London and Amsterdam. Second, we were looking to develop closer relationships with groups of developers that would be able to help us iterate and test initial tool prototypes locally. As part of this effort we attended a local conference on IoT in Malmo (IoTConf.se), local meet-ups for the Hardware Alliance - a nascent group of hardware oriented startups and consultancies, as well as spent time with traditional design consultancies and alternative groupings of IoT and hardware makers and activists.

As we conducted our fieldwork we got asked several times “what kind of ethics are you interested in - personal ethics, company ethics or societal ethics?” This initially took us by surprise, but over time we noted that across our fieldwork people often made these distinctions. Where “societal ethics” often had to do with the logics of cybersecurity and the arguments made about the needs of the state as well as the policies and regulations that the state enacts. What is considered good for one society might not be for others and not all state policies are agreeable. The needs of the state in areas such as surveillance as part of cybersecurity might be at odds with individual attitudes but it is a matter of who or what must be prioritized, the institutions or the individuals that make up these. Company ethics focuses more on the market needs and logics. We often observed arguments about survival of startups as key drivers of various decisions, while personal ethics is about individual desires, needs or principles. Whereas large-scale corporations might cultivate particular logics of what constitutes right or ethical behavior, the VIRT-EU project's focus on start ups and SMEs argues for a shorter distance between company and personal ethics, but we observe often that business and personal concerns represent different sources of ethics and as the stakes shift so do the principles.

Throughout this fieldwork we noted repeated concerns and issues that were brought up and debated across all of our encounters. Chief among these was the question of "who owns the data” that is made more complex with the addition of the hardware components. As we questioned whether issues of data ownership are particularly distinct within IoT, we observed and discussed with our interlocutors the specificity of problems that the hardware/software combinations of IoT bring up. We noted repeated and conflicting concerns about standards, regulations and the need (or lack thereof) to be aware of these. We also discussed issues of security and privacy that were rife with expectations of how end/users ought to act. Throughout our fieldwork, we noted the importance and dominance of large multinational actors such as Google, Apple and Microsoft in shaping the expectations and to some extent decisions about how to design technologies for many. In seeking to observe and consider ethics as values in action, the analysis below explores what developers and designers seem to think is special, problematic and distinct

about working with IoT devices and services and what sorts of assumptions seem to be at play in discussions about data ownership, compliance with standards and considerations of security.

5.3.1 What's so special about IoT anyway?

Although the IoT sector clearly struggles with some similar issues of personal data management, mounting privacy concerns, an increasingly complex regulatory environment and managing activities in an environment dominated by few multinational actors, there are extra problems that hardware brings along. As an expert from a design consultancy told us, "it's a cyber-physical system and this creates very important differences." The problem is that when IoT devices physically instrument environments and begin to generate data - new systems and new relationships must be negotiated. Whether it is air quality measurement, instrumenting of water services or putting a futuristic gadget into a private home, the very physicality of these devices makes issues of data ownership, reliability and adherence to safety and security standards more acute. As a design consultant put it: "existing standards as already having ethical premises built into them. Standards are good and established processes for hardware manufacturing where risk assessment and especially safety systems have always been important. It used to be that you wanted to make sure that the device won't cut off someone's hand if things go wrong, but now you also want to make sure that the device does not leak important data - so you have gone from starkly functional to much more complex and conceptual notions of risk and safety." In this, existing hardware development standards continuously fall short of rapidly developing technical underpinnings of hardware enabled data infrastructures of IoT.

This combination of the situatedness and reality of hardware and the abstraction of software requires that new relationships, expectations and obligations are negotiated, made evident and clear. The problem is that few service providers, startups and even mature companies quite realize that this is the case just yet and, as one consultant put it: "we don't yet have much of an idea of what is ok and not ok." In other words, the ethical decision making about what is "good behavior" does not have real precedents or pre-existing experience to guide it. If these developers were attempting to be virtuous, then what constitutes virtue in this case, is clearly not yet agreed upon. As Vallor would argue, the communities of IoT developers must cultivate new virtues within themselves and in collaboration with their stakeholders.[54] Mol[55] and Puig de la Bellacasa[56] might point to the need for thinking in terms of relations, obligations and care as guides to these decisions precisely because building new systems requires acknowledgment and renegotiation of relations. At the same time the shifting standards and new regulations continuously shape and structure what sorts of decisions might be made. This is one explanation for why we have previously observed high levels of anxiety among designers and developers, resulting in a profusion of manifestos.[57]

In a meet up, startup founders argued that "selling hardware alone is just not a sustainable business model" and this sentiment was expressed again and again in different ways. IoT is not merely a variety of physical objects that now do smart things, but HeSaaS - Hardware Enabled Software-as-a-Service

[54] Vallor, S., 2016. Technology and the virtues: A philosophical guide to a future worth wanting. Oxford University Press, United States of America.
[55] Mol, A., 2008. The Logic of Care: Health and the Problem of Patient Choice, 1 edition. ed. Routledge, London ; New York.
[56] Puig de la Bellacasa, M., 2017. Matters of care: Speculative ethics in more than human worlds. University of Minnesota Press, Minneapolis.
[57] Fritsch et al. 2018

infrastructures. Some argue that the quality of software is more important than the complexity and quality of the hardware, others disagree but this depends on the kinds of hardware and services they intend to offer. That is, instead of relying on the end-user to purchase a motley of hardware from myriad hardware providers and then install whatever software is on offer to receive a service, as is typically done now, IoT systems and services are trying to achieve vertical integration and platform dependency "like Apple but with a bit less complexity" as one developer put it. IoT systems are built around data collection and service provision based heavily on in-situ data collected through the various efforts of the end-users using particular custom-engineered devices (from wearing devices, to installing them on water pumps). Consider a company that creates air-quality sensors for cities to use, or one that develops and installs smart meters for the city water authority, or one that produces cheap tiny gadgets that plug into television screens to allow computers to connect without the mess of cables and wires. In all cases here, the companies engineer the hardware and develop the software. The software includes data processing capabilities that enable the "smartness" of the hardware and the companies typically also store and manage the data that these hardware devices collect. As the hardware begins to collect data, these companies run data analytics and develop new services based on the data that they use to improve their own products and to offer new services to their customers. If these companies own the data produced by the hardware devices (as opposed to their customers owning the data), they can also sell both data and analytics to third parties.

Considering the problems encountered by these companies brings up a host of recurrent questions: Is ownership of hardware the same as ownership of the service that is provided through that hardware? This becomes particularly tricky when government institutions such as community water services are involved or when the hardware itself is costly to produce and thus purchase. If the hardware is only usable when the software aspects of the system are enabled, is it reasonable to require ongoing payments for these software services? For many small startups a route to such subscription models and recurrent revenue seems like the only way to thrive. If the basic service is possible to provide without routing all data through company servers, is it reasonable not to offer such an option? If there is a strongly embedded belief that hardware is not enough for survival of smaller startups, then offering standalone and independent devices without any reason for a continuous ongoing relationship will remove or limit any possibility of recurrent revenue and thus survival. If the customer (such as a city for example) decides to remove some of the hardware for whatever reason, thus changing the efficacy of the services that rely on the data produced by that hardware, do they have the right to do so and what recourse might the provider have? Such a question leads to the final and perhaps most important issue, who owns the data collected by the hardware components and how must these data be treated and managed? The answers to these questions vary dramatically and depend on current regulations as well as existing assumptions of what the customers or end-users want or care about. We see some of the efforts to answer these questions articulated in our fieldwork on the IoT Mark (see above) as well.

5.3.2 Assumptions of data - who owns the data?

In any discussion of ethics and IoT there is a strong tendency to equate questions of ethics with questions of how data are managed and treated (as we have observed in London and Amsterdam fieldwork as well). The implementation of GDPR has made such conversations actionable but often limits many concerns within the structures of legality and compliance. Yet from an ethical point of view, just because something might be legal, it is not necessarily something that ought to be done. The question of who owns the data given the complexity of IoT HeSaaS infrastructures is one of the primary concerns. When

discussing these issues with companies who deal with cities, utility companies or authorities and other institutional or government actors, the struggles focus on existing regulations and negotiations of rules and policies.

For example, one company provide hardware for cities and have patented proprietary methods of data processing but they wonder whether this is actually the right way to go. They admit that they can do the processing locally on the devices and on the cloud, however if processing is done locally then black boxing the algorithms is much harder than if it is done on the cloud. They are concerned with protecting their intellectual property in this case, but they are also concerned with ways to keep their customers (in this case cities) constantly engaged. They are selling this technology to the cities but they would like to create a situation where the cities are not actually allowed to remove the hardware (to keep the efficacy of data collection constant) and do not own the data (to allow the company to do whatever processing or even sales of these data that they might find profitable), just have access to it. Of course, it is difficult to get customers to agree to this arrangement because they are asking quite hefty prices for the expensive hardware. The developers and founders sincerely believe that their technology provides real value to the cities that will use it and do not see any contradiction with owning city data, but are increasingly concerned with what is possible given the regulatory landscape and city policies.

In most cases that we have observed, whether in B2B or consumer oriented products, there is a fundamental expectation that companies that provide the hardware will route all data through their servers whether or not that is actually necessary. As one startup CEO noted: "there is a trend among users that others own data about you so on that basis companies can go ahead and expect to own the data too." Such normative statements that "people are used to giving away their data" or that "people don't care about data anyway" are common and we have noted these in London fieldwork as well as across much existing literature. There are underpinned by arguments that leverage the notion of the privacy paradox - people say they care about privacy but give away their data for a nickel anyway.[58] Although we might argue that such attitudes towards personal or even city data are unethical, this is not necessarily so. IoT developers and designers inhabit the same world as their customers and it is a world that is built on the basis of a predatory data extraction economy,[59] where virtues of technological innovation are constantly extolled. If the structural conditions of data extractions are accepted and internalized as necessary for achieving a "good life" with technology then a lack of concern for personal data is in fact virtuous as it is cultivated within and across communities. Given the level of agreement with such statements that we have observed in meet ups in Copenhagen, at least among this community has deeply internalized such values. Data then become attributes and tradable objects[60] rather than matters of relational negotiation, matters of care.

[58] Norberg, Patricia A., Daniel R. Horne, and David A. Horne. "The privacy paradox: Personal information disclosure intentions versus behaviors." Journal of Consumer Affairs 41.1 (2007): 100-126.
[59] Zuboff, Shoshana. "Big other: surveillance capitalism and the prospects of an information civilization." Journal of Information Technology 30.1 (2015): 75-89.
[60] Shklovski, I., Vertesi, J., Troshynski, E. and Dourish, P., 2009. The commodification of location: dynamics of power in location-based systems. In Proceedings of the 11th international conference on Ubiquitous computing (pp. 11-20). ACM; Shklovski, I., Troshynski, E. and Dourish, P., 2015. Mobile technologies and the spatiotemporal configurations of institutional practice. Journal of the Association for Information Science and Technology, 66(10), pp.2098-2115.

5.3.3 The problem of standards and regulations

Standards and regulations are important points of discussion among IoT developers and designers across our field sites. Standards are both choices (what network protocol to choose, as is the case between LORA and Sigfox) and guidelines that can help decide what are the "right" ways to act. Across our fieldwork we also observed passionate discussions about the difference between ethical behavior and compliance where going beyond compliance was often seen as the "right thing to do". Yet what was meant by "beyond compliance" varied.

Standards are articulations of values and underpinned by ethical concerns. These arise out of the need to institutionalize particular behaviors as "right" for whatever reason. A typical example of the work of standards looks like this. Imagine a company that developed tracking bands for elderly with dementia. When someone with such a device gets lost in the woods the question is who is to blame. The company might blame the lack of network connectivity but if there was a standard for testing devices to make sure that built in connectivity works well and there are ways to productively cope with network failures, then such events might be less likely to happen. Standards then are attempts to convince companies to do extra testing and certification and, when such standards are voluntary, work done towards certification can be seen as an ethical act rather than merely attempts to ensure regulation compliance.

Another discussion of beyond compliance however, looks to restrictions put by existing regulations that might limit the use of new technologies and argues for end-users or customers to "go beyond compliance" and use new devices anyway. Many smart city technologies face a problem because high upfront costs in implementation makes it likely that cities are not willing to go for it because they do not want to go beyond what is required by local, state or EU regulations and developers then have to argue for the importance of their customers "going beyond compliance" as part of their sales pitches. For example, a company that produces and sells air quality sensors to cities produces cheaper and lower cost devices that are easier to maintain and more flexible than the kinds of air-quality measurement stations currently mandated by the EU. The company argues that their solution is "better" but the legitimate question is what does "better" actually mean? The EU regulation does not accept the level of error these devices produce as reasonable for use as official reporting devices (they are just not accurate enough) so these devices do not and can not replace the traditional reference stations that most countries use. The company believes that having more devices throughout cities will produce better measurements overall because of the ability to normalize across many data points. This is in part because most cities have few measurement stations on account of their being very expensive and difficult to maintain and thus city pollution levels do not really reflect pollution levels across the whole territory but only in very particular locations. They are then actively working on lobbying for updating and making EU regulations more flexible because they claim that current limits are too old and conservative.

In this case how inaccurate are these devices is a legitimate question. This question is asked in the context of the discussion of whether there is a way to leverage the scientific domain. However, for the scientific community the errors are big enough to be not usable, because scientists tend to have very particular and narrow expectations for accuracy. It is possible to build more complex models for processing noisy and less accurate sensor data but these models are harder to use and would require a lot more engineering and software development that would be very costly. What might such a company do and what are the ethics of these decisions? In the meet ups and debates that we observed, a very typical advice is to leave the over-regulated environment of the EU and move to places and markets

where pollution is a bigger problem and regulations are not so tight. This is met with agreement and positive feedback as regulations are seen as barriers to be overcome. The company argues that their goal is to provide knowledge to a broader range of people about the levels of pollution in their environments. Yet they do not really have much of an answer when asked what are the potential drawbacks of such a knowing. The underlying value of knowledge as an inherent positive drives much of the decision making in this case and many others.

Thus when talking about compliance and going beyond compliance, we see one version of this as clearly a statement of ethical behavior while the other may start to look ethically questionable. Yet where in the first case we see expressions of what we might attribute to internal virtues, the second case questions the existing structures and capabilities of both the companies themselves and their customers, pushing to change or augment these infrastructures.

5.3.3 What about security?

Despite the enormous looming problem of security in IoT, in Copenhagen fieldwork we rarely observed concerns or discussions about it. Even during in-depth discussions of which network protocols or cloud services particular products might use, the question of security very rarely came up. In discussions of HeSaaS in meetups much more attention was given to software and even with complex and expensive hardware, most companies saw their hardware devices as merely enablers of the Software-as-a-Service they were providing. If hardware gets less attention then issues of security are mostly addressed at the software level, where for many startups the use of major cloud services such as Google or Amazon and reliance on the tools these giants provide absolve them of worrying about many such questions. In fact the major multinationals were often treated with much respect as one CEO noted: "we are not trying to compete with the amazing tools made by Google and Microsoft and Apple, we are all about integration." For many founders, these multi-nationals come to define the standards they should aspire to and what constitutes "good" practices. The corporate ethics these giants model then come to define much technical and start up ethos among at least this smaller developer community.

5.4 Insights from co-design sessions

Task 3.4 (co-design & stakeholder workshops) – round one completed; round two to be completed by M20

Co-design workshops took place during 2018, building on the networks and field embeddedness of the ethnographers conducting research in Amsterdam and London. These co-creation workshops were composed of IOT developers, designers and CEOs from small companies or startups, recruited through the network that the ITU and LSE teams have established in their respective field sites. Each workshop was composed of 4-7 individuals. We held a total of 2 in each location, where each workshop was approximately 3 hours. All of the data from the workshops have been saved, shared and analysed securely, according to individuals' consent.

To these workshops, the CIID team brought several tools based on the preliminary research that the anthropology teams had already conducted. These tools evolved from our initial workshops in Amsterdam to our second round in London. We focused our tools on the four themes:

Zooming in - what is the product's impact from its inner materials outwards?

- Connecting materials and values, and then focusing on moments when a material pulled a value into tension - who was surrounding that moment and how did they get their information? What decisions was made and how did that skew the values previously stated?
- Understanding the ecosystem around a product and a given decision in that product

Zooming out - what is the product's potential impact on a more systemic level?

- Considering the positive and negative impacts on a variety of levels (social, cultural, economic, ecological) - and writing full scenarios about these impacts - of an IOT product if it had the success they desire
- Given these impacts, what kinds of ethical tools might they need in order to address these possible impacts before they happen?

In our observations and brainstorms with developers during the workshops, we noticed the following patterns:

A. Awareness: to help become aware and navigate a possible problem before it might occur - here we seek to both visualise and structure understanding how small and big decisions can change the product's alignment with its own stated values. These decisions do not occur in a vacuum - they are interconnected with many actors in the company - from developers to business designers to investors and advisors.
B. Unpredictable impacts: creating unimaginable repercussions or otherwise ignored possible user groups to help push the company's assumptions for their product as well as extend their understanding of who and what are affected by their choices.

5.5 Speaking across sites - research synthesis effort

Tasks 3.5/4.5 – Outcomes of the analytic seminar for interim research exchange between WP3 & WP4

Synthesis events are important in bringing together themes of research underway at different sites. For the Consortium Meeting in Copenhagen in May, 2018, we designed a workshop that required preparatory reflection, and brought Consortium members together around the question of ethics in developer and design practices. Using the project's initial orientation to ethics as 'values in action', consortium members were asked to generate value maps of the kinds of values they have seen enacted and articulated by IoT designers and developers in the course of their research. These were arranged around the three basic frames of "Where, Who and When", elaborating on when and how values around ethics are surfaced, and by whom. Our intention was to use this value mapping to make visible contrasts and similarities in ethics in practice between different ethnographic field sites as well as between different types of data collected across the project activities. These answers were then channeled into collaborative discussions about outcome goals for the project, that acknowledged the distinction between an ideal outcome and a possible outcome. The normative discussion provided groundwork for a generative debate that enabled all consortium members to participate in conceptualizing a VIRT-EU practical framework for ethics that we will use to ensure that our tool

prototypes, while firmly grounded in the realities of empirical data and co-design activities, nevertheless draw upon a coherent theoretical basis.

6 Towards a Privacy, Ethical and Social Impact Assessment (PESIA)

6.1 The PESIA model in the context of the data protection regulatory framework

Task 4.2 (Defining a methodology for PESIA) – completed

In a recent document, the French Data Protection Authority (CNIL) reported the results of its public consultation on algorithms and Artificial Intelligence, pointing out that "Participants in the public consultation which the CNIL organised in Montpellier on 14 October 2017 came up with recommendations […] 97% of participants think that "developers should build a certain ethical framework into their practices and resist some tempting market incentives". 94% thus call for the development of ethical charters in this regard and 56% would like social and human science experts to help developers to better gauge the impact of their work on society".[61]

The development of the PESIA model represent a possible answer to this demand. The availability of a Privacy, Ethical and Social Impact Assessment tool may facilitate developers in embedding ethical and social values into their practices and in the devices they build.

Assessing ethical and social impact of products and services may require a significant effort in terms of time and resources, as demonstrated by the experiences in the field of Social Impact Assessment.[62] For this reason, an easy-to-be-implemented self-assessment tool may represent a solution which can be adopted by a large number of developers, despite their size and the nature of data they process.
Obviously, in the case of high impacts of data processing, this self-assessment will be the early stage of a broader analysis. Significant social consequences of data processing may require the involvement of experts in the assessment process, as well as forms of stakeholders' engagement addressed to the groups of people potentially affected by data use.

In terms of evolution of the regulatory framework,[63] this new model of assessment may represent one of the highest points of the parabola of accountability in data processing. The initial models based on public authorities' assessment, the elements of risk management later introduced in data processing operations, the role played by data subject's consent in self-assessing the consequences of data

[61] See CNIL. 2017. How Can Humans Keep the Upper Hand? The Ethical Matters Raised by Algorithms and Artificial Intelligence. Report on the Public Debate Led by the French Data Protection Authority (CNIL) as Part of the Ethical Discussion Assignment Set by the Digital Republic Bill, p. 53 https://www.cnil.fr/sites/default/files/atoms/files/cnil_rapport_ai_gb_web.pdf.

[62] For further references and a discussion on the potential role of Social Impact Assessment in data protection, see also Mantelero. A. 2018. AI and Big Data: A blueprint for a human rights, social and ethical impact assessment. Computer Law & Sec. Rev. https://doi.org/10.1016/j.clsr.2018.05.017.

[63] On the notion of regulatory framework used in this project, see also Deliverable 2.2, https://virteuproject.eu/sites/virteuproject.eu/files/Deliverable%202.2_FINAL.pdf.

processing,[64] till the recent DPIA required by the GDPR, are different stages of a progressive refinement of the assessment procedures.[65] A broader vision which also considers societal and ethical issues complete this evolutive scenario.[66]

6.2 The nature and purposes of the PESIA model

The PESIA model is developed in this project as a voluntary solution. This is in line with the aim of this project, which is to create a tool that can contribute to change the existing paradigm, suggesting a different ethically and socially oriented development of digital devices.

In this sense, PESIA is not a standard. The definition of a standard needs a sufficient number of entities which are keen to adopt it, the convergence between the different actors in a given market and a specific entity entitled to maintain the standard. The variety of the IoT markets, the fragmentation of many sectors make it difficult to adopt a global standard in the EU area.

Moreover, the Virt-EU project does not aim to provide a sort of ethical or social check-list, but to enable data controllers (e.g. IoT developers) to have a clearer idea of the potential social and ethical implications of their data use. At the same time, controllers remain free to autonomously decide whether and how to address these implications.

Finally, the PESIA adopts an open and participatory approach[67] and the outcome of this assessment can be publicly available. Therefore, the adoption of the PESIA model contributes to reinforcing data subjects' self-determination, as it makes explicit the dynamics of data uses, increases data subjects' awareness and facilitate their meaningful choices regarding data processing.

To reach these goals, the PESIA development has to address its main challenge, which is represented by the definition of the ethical and social values which are used in the assessment. Indeed, such a larger concern for the alignment of data use with ethical and social values implies a more complicated analysis than the traditional data protection assessment.

Whereas the driving values behind data security and data management are technology-based (e.g. integrity of data) and thus can be generalised across varying social contexts, the situation with regard to social and ethical values is different. These are necessarily context-based and differ from one community to another, making it hard to pinpoint the benchmark to adopt for this kind of risk assessment.

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[64] See Mantelero, A. 2018. Comment to Articles 35 and 36. In Cole, M. and Boehm, F. (eds.). *GDPR Commentary* (Edward Elgar Publishing, forthcoming).

[65] For an analysis of the evolution of the described stages, see also Deliverable 2.2, https://virteuproject.eu/sites/virteuproject.eu/files/Deliverable%202.2_FINAL.pdf, and Deliverable 4.1, https://virteuproject.eu/sites/virteuproject.eu/files/D4.1%20VIRT-EU%20FINAL.pdf.

[66] See Wight, D. and Mordini, E. 2012. Privacy and Ethical Impact Assessment. In Wright, D. and De Hert, P. (eds) *Privacy Impact Assessment* (Springer Netherlands 2012) 397–418. See also Mantelero, A. 2017. Regulating Big Data. The guidelines of the Council of Europe in the Context of the European Data Protection Framework. 33 (5) Comp. Law & Sec. Rev. 584-602.

[67] In this sense, in literature, authors have supported participatory model against elitist approaches based on experts. See Otway, H. 1987. Experts, Risk Communication, and Democracy. 7(2) Risk Analysis 125, 126 ("The view of decision making implicit in acceptable risk studies could be called technocratic, elitist, or maybe just "perfect-world" analysis, but it did nothing to further democratic process because the judgment of acceptability was seen as a matter for risk experts that we could tell people what was best for them").

6.3 The architecture of values supporting the PESIA model

To address this challenging scenario briefly described in the previous section, the "architecture of values" that supports the PESIA model should be articulated on different levels. It should preserve a uniform baseline approach in terms of common values, but, at the same time, be open to the community traits and demands, as well as address the specific question posed by the societal impact of each given data processing.

For these reasons, the PESIA model is based on three different layers of values. The first of them is represented by the common ethical values recognised by international charters of human rights and fundamental freedoms. This common ground can be better defined on the basis of the results of the ongoing analysis of the decisions concerning data processing adopted by the EU data protection authorities, Article 29 Data Protection (and now European Data Protection Board), European courts (European Court of Justice and Europe Court of Human Rights).[68]

The second layer takes into account the context-dependent nature of the social and ethical assessment and focuses on the values and social interests of given communities. Finding out these values is more difficult, since they are not codified in specific documents. Thus, the solution adopted in this project consists in analysing different sources which may provide a representation of the values characterising the use of data in a given society.

In the light of the above, the ongoing research on the PESIA values is focused on the analysis of the decisions adopted by data protection authorities in the European Union, trying to figure out the driving ethical and social values that may have underpinned the authorities' decisions. This is not an easy task, since frequently the relevance of these values is not clearly affirmed in the decisions, whose authors prefer to use more formal legal arguments. Further sources to envisage the societal values at a community level may be the developers' privacy practices as well as available ethical and privacy practical tools and frameworks.[69]

Finally, the third layer of this architecture of values consists in a more specific set of values that can be provided by the ethnographic studies of the developer's communities,[70] which are identifying the specific social and ethical values that underpin developers' initiatives.

[68] On the basis of keyworks pertaining to abstract privacy, ethical and social values, we initially selected and analysed 554 decisions adopted by different Data Protection Authorities and 100 documents adopted by Article 29 Data Protection Working Party. In second phase, we reduced the number of the relevant decisions to 190, which have been analytically examined. Regarding the European courts, due to the different nature of these bodies and of the related procedures, the number of cases is smaller than Data Protection Authorities' decisions (138). The complexity of this analysis is due to the fact that the discussion of the relevant interests and values is frequently curtailed or not adequately elaborated in the decisions adopted by Data Protection Authorities and courts.
[69] See Deliverable 2.2, https://virteuproject.eu/sites/virteuproject.eu/files/Deliverable%202.2_FINAL.pdf,
[70] See Deliverable 2.2, https://virteuproject.eu/sites/virteuproject.eu/files/Deliverable%202.2_FINAL.pdf,

6.4 The PESIA model

Regarding the PESIA architecture, it is built on the existing PIA/DPIA models, which are structured as risk assessment questionnaires. This is due to three different reasons:

Outcomes from Task 4.2 outline the process for Task 4.3 (providing general & sector-specific guidelines for PESIA) to be completed in M27

- First, similarities with the PIA/DPIA existing models facilitate developers in moving from the assessment tools they already use – or have to implement pursuant to Art. 35 GDPR – towards a broader impact assessment.
- Second, the PESIA is a Privacy, Social and Ethical Impact Assessment, therefore its first section is devoted to traditional privacy/data protection impact assessment, which is basically questionnaire. Reasons of internal consistency suggest us to develop also the other sections of the model in the same way, although they focus on societal impacts.
- Finally, not only PIA/DPIA, but many risk assessment models are traditionally based on lists of questions. This structure helps those who carry out the assessment to understand, recognise and evaluate the consequences of their decisions concerning the different stages and elements of product/service development.

Against this background the Virt-EU reach unit at the Polytechnic University of Turin examined fifteen different PIA/DPIA models.[71] Some of them were provided by DPAs before the entry into force of the GDPR, while others have been adopted during the last year and are based on the GDPR provisions.

The availability of assessment models before and after the GDPR makes it also possible to verify whether the new Regulation had an impact on these assessment procedures. In this regard, although

[71] Regarding the EU area, these are the analysed models: Commission de la Protection de la Vie Privée (Belgium). 2016. Projet de recommandation d'initiative concernant l'analyse d'impact relative à la protection des données et la consultation préalable soumis à la consultation publique (CO-AR-2016-004); Autoritat Catalana de Protecció de Dades for Catalunya (Catalunya, Spain). 2017. Avaluació d'impacte relativa a la protecció de dades; Commission Nationale de l'Informatique et des Libertés (CNIL). 2015 and 2018. PIA Methodology ; Commission Nationale de l'Informatique et des Libertés (CNIL). 2015 and 2018. PIA Tools; Commission Nationale de l'Informatique et des Libertés (CNIL). 2015 and 2018. PIA Good Practices; Conference of the German Independent Data Protection Authorities of the Bund and the Länder (Germany). 2016. The Standard Data Protection Model. A concept for inspection and consultation on the basis of unified protection goals, V. 1.0 – Trial Version; Health Information and Quality Authority (Ireland). 2010. Guidance on Privacy Impact Assessment in Health and Social Care; Dutch Data Protection Authority with NOREA (Netherlands). 2015. Privacy Impact Assessment (PIA) Introductie, handreiking en vragenlijst; Agencia Española de Protección de Datos (Spain). 2014. Guìa para la Evaluación de Impacto en la Protección de Datos Personales (EIPD); Information Commissioner's Office (UK). 2014. Conducting privacy impact assessments Code of practice. For a comparative study, We have also analysed the following PIA models adopted outside the EU area: Office of the Australian Information Commissioner (OAIC) (Australia). 2014. Guide to undertaking privacy impact assessments; Privacy and Legislation Branch - Office of the Chief Information Officer (British Columbia, Canada). 2014. Privacy Impact Assessment Guidelines; Office of the Privacy Commissioner of Canada (Canada, Federal Government), 2011. A Guide for Submitting Privacy Impact Assessments to the Office of the Privacy Commissioner of Canada; Office of the Information and Privacy Commissioner (Canada, Ontario). 2015. Planning for Success: Privacy Impact Assessment Guide; Office of the Privacy Commissioner (Hong Kong). 2015. Information Leaflet on PIAs; Privacy Commissioner (New Zealand). 2015. PIA Toolkit. We are grateful to Laura Greco (Polytechnic University of Turin) for her significant contribution to this analysis.

article 35 GDPR has undoubtedly boosted the adoption of these self-assessment models,[72] the results of our study do not show a significant impact on the most recent assessment models.

The broad provisions about the focus on "rights and freedom of natural persons" (Article 35 GDPR) and the references to "discrimination" and "any other significant [..] or social disadvantage" (Recital 75) has not led neither EU legislator nor DPAs to develop assessment procedures which properly consider societal issues although the attention to ethical and social issues in data processing is growing.[73]

In this regard, although the analysed PIA/DPIA models do not help in the identification of ethical and social values, which seem not to be mentioned, our cross-analysis showed the commonalities among the existing European models. This represents an important result to detect which features are the most important and which could be the structure to follow within the creation of a PESIA model.

Regarding the section focused on social and ethical issues, this represents the main challenge and the core of the model. While PIA and DPIA, as well as the literature on these models, provide a variety of solutions concerning data protection impact assessment, ethical and social assessment in data use is largely unexplored.

For this reason, the architecture of values mentioned above represents both a contribution to the literature in this field and, from an operative perspective, a key element in outlining the PESIA questionnaire. In fact, the different questions will consider the variety of values which have been identified in the prior analysis of data protection jurisprudence, encouraging developers to take them into account. Short cases and examples will also facilitate developers to better understand these questions and their background context.

From a legal perspective and according on our on-going analysis, these values mainly concern private sphere and intimacy, individual identity, physical integrity, human dignity, autonomy, respect of diversity, freedom of expression, freedom of movement, and freedom of education. But there are also operational values, such as interoperability, data portability, transparency, security & safety, accountability, and participation.

These legal values that underpin many Data Protection Authorities' decisions, as well as the GDPR framework, are largely consistent with the values recognised in the IoT manifestos, which focus on ubiquity and invisibility, transparency, openness, control & privacy, responsibility, understandability, debate & dialogue, togetherness, shareability, diversity, equality, inclusion, and sustainability.[74]

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[72] On the role of self-assessment in DPIA and GDPR, see Mantelero (n 4).

[73] See, e.g., EDPS. 2018. Ethics Advisory Group, 'Towards a digital ethics' https://edps.europa.eu/sites/edp/files/publication/18-01-25_eag_report_en.pdf; Council of Europe. 2017. Guidelines on the protection of individuals with regard to the processing of personal data in a world of Big Data, https://www.coe.int/en/web/human-rights-rule-of-law/-/big-data-we-need-to-protect-the-persons-behind-the-data. See also Council of Europe-Committee of experts on internet intermediaries (MSI-NET). 2018. Study on the human rights dimensions of automated data processing techniques (in particular algorithms) and possible regulatory implications https://rm.coe.int/algorithms-and-human-rights-en-rev/16807956b5.

[74] See Ester Fritsch, Irina Shklovski and Rachel Douglas-Jones. 2018. Calling for a revolution: An analysis of IoT manifestos. In Proceedings of the 2018 ACM Conference on Human Factors in Computing (Montreal, Canada, 21-26 April 2018) http://delivery.acm.org/10.1145/3180000/3173876/paper302.pdf?ip=80.180.146.48&id=3173876&acc=OPEN&key=4D4702B0C3E38B35%2E4D4702B0C3E38B35%2E4D4702B0C3E38B35%2E6D218144511F3437&__acm__=1525873755_622581693e4344f67627f0aec1be630b.

7 Addressing ethics in practice

In this section, we describe early ideas and design prototypes that emerge from a combination of our desk research and co-creation workshops with the IOT developer communities, the latter described in Section 4.4

Task 3.4 (outcomes of co-design workshops) & preparation for Task 5.2 (tool prototyping & design) (M18-M29)

7.1 Desk Work

Prior to undertaking co-creation workshops, we undertook a range of desk work activities. We first identified tools that currently exist that attempt to address ethics - and as much as possible - ethics as it relates to IOT development. At the same time, we sought out tools that are more analogously inspirational to our work, though not necessarily specifically designed for IOT developers. Javier Ruiz from the Open Rights Group along with CIID conducted extensive surveys of the field of ethical tools - encapsulated in an ORG report disseminated internally.

7.1.1 Identifying Gaps

It is the goal of our tools to support IoT creators in reflecting on and addressing ethics while making IoT devices. However, it was important to attune these both to existing tools and to the current and specifically IoT climate. From the desk research conducted by CIID, the consolidated ORG report as well as reporting from the fieldwork by the anthropological teams (LSE and ITU), we have identified the following gaps in terms of tools that would support IOT creators to reflect and address ethics while making IOT.

These gaps in existing tools are not absolute - some tools try to address one or the other - but few tools address any one of these gaps with the thoroughness it requires.

1. Most notably, the tools that exist currently lack the ability to truly take into account change and input over time. As such, they do not reflect the evolution of a company's decisions and how those decisions do or do not match the company's material product choices.
2. Together with point 1, we see a lack in active integration of legal aspects upon which said decisions might infringe.
3. There is very little consideration of social discussion that can enhance an individual's understanding of a given issue. How have their peers dealt with this issue? How would their peers review their decision or solution? Would there be a way to integrate willing and able legal/ethical experts as reviewers in the process of decision-making.
4. Though considering unpredictable outcomes is crucial to these tools addressing tensions that have not yet occurred but may occur in the future, there is little to no attention paid towards immersion in speculative outcomes and even more - structured speculation to enforce that creators consider where their product might go if certain technological developments (whether negative or positive) were to occur.
5. Many IOT developers describe that their sense of ethics and company values often become more or less prioritised and even misaligned when they are choosing certain materials that compose their product, and secondly, when they have meetings with investors and other stakeholders.

Yet the current ethical tools do not seek to facilitate or prepare creators for the difficult discussions that will take place around the material and investor decisions.

7.1.2 Finding Inspiration

Existing tools provide several inspirational methods and modes of querying that structure reflection on ethical practices. It should be noted that these techniques were designed both for IoT and other technologies.

1. What is the context and potential impact of your product? What are the tensions in it and causes for those tensions? What are alternative technologies and methods you could use to address those tensions? Assessment of final decisions.
2. How can documents that state principles, obligations and guidelines be supported with accountability for complying with such self-stated plans?
3. How can tools ensure that they reflect specificity of context, of location?
4. How can the tools allow for continuous dialogue over the lifecycle (and beyond) of the product? Can the tools be designed such that they would integrate user-driven evolution - that is, open sourced and changing with the changing technologies that will need to be addressed as we progress?
5. If decisions are not quantified, how else can they be evaluated? Are there actionable outcomes or simply aid for deliberation?
6. Scenarios, and especially case studies, can demonstrate dilemmas, for people to discuss alternatives and prepare for positive solutions - whether solutions that will have to be made now or in the future.

To these key insights from the desk research, we add consolidated observations from the series of co-creation workshops that we held in Amsterdam and London with IoT creators. These, as discussed above in Section 4.4 primarily concern the relationship between awareness and navigation of challenges, and the capacity to imagine possible futures for products.

7.1.3 Outcomes for Design Scope and Brief

From our experiences at the co-design workshop and desk work reviewing available tools and techniques, we found considerable potential for our design scope.

- First, addressing the difficulty articulated in the co-design workshops, our tools could allow developers to articulate and structure possible gaps between their material choices and stated values - empowering them to map, question and discuss these gaps, as well as demonstrating to them when and how these "gaps" might lead to major legal repercussions.
- Second, these reflections can help order and organise values in a structured way. For example, a mapping of values can stretch from an individual's personal sense of values and ethics to a company-wide statement to a product-specific statement. In order to identify where and why breaks or gaps might happen from a stated value to a material choice.
- Third, mapping the possible problems out can clarify possible mismatches in capabilities - for example, that an individual sought to make X choice but did not hold the ultimate decision power. Why does a given company compromise on their personal/company/product values? We will run an exercise to uncover this by asking “If you had everything you needed, what would

you do differently?" in relation to their ingredient choices. Though simplistic, this exemplifies the "capabilities ethics" underlying theory that LSE has identified as relevant to the IOT context.

- Fourth, our tools could empower developers to speculate; in order to question assumptions about the above gaps, participants need help to be aware of unexpected system-level repercussions or cultural differences in how a product is used and what kind of impact it could have. Here we aim to provoke reflection and discussion with several speculative design framings. For example: on a local / global level (choose one) what kind of social / ecological / economic / political impact (choose one) might your product have, if everyone in the world used it? Consider positive, negative possibilities and map out a full tree of scenarios. This kind of work can reveal invisible networks of care, aligning us with the "care ethics" approach. Linking the speculation to the mapping in the above paragraph, we also consider an iteration or addition to the speculation whereby we would structure the "diff" between the participant's least desired possible outcome and a dream scenario where they would have all of the resources in the world - how would they avoid this outcome? How/would they change their product to avoid it?

7.1.4 Early ideas

Our early ideas, explored below, are in no way fully developed not are they explicit statements of what our team will create. Instead, they are indications of our spaces of current exploration based on the insights we have gathered from our research and discussions with the project's researchers and advisors. Both foreground the foundational challenge identified through our review of the existing tools available: they do not reflect the evolution of a company's decisions and how those decisions do or do not match the company's material product choices.

These ideas gesture at possible mechanisms and experiences we consider worth pursuing further. As such, we request that you read the below statements as signs of our process as opposed to a finished output. As the project progresses, over the course of the upcoming months we will map out and refine various ideas based on these identified spaces and co-design them with our experts in-house at the Copenhagen Institute of Interaction Design - as well as with our IOT design community in Copenhagen.

The "ethical footprint": An interactive tool that lives and evolves with your product.

Concept: As you make certain decisions in terms of your product composition, you drag and drop these new components into a product composition window and a visualisation - your Ethical Footprint - will change accordingly - growing and morphing to reflect how your choices are either supporting or subverting your stated personal / company / product values.

This idea uses the familiar concept of the footprint - also used in sustainability reporting, for example - and builds upon it, employing it as a way to keep a team on the same page (often only connected digitally). The tool's understanding of whether or not certain decisions align with the values could be based on a database of collected and curated examples from our developer community, advisory board, VIRT-EU researchers and legal cases. Instead of necessarily visualising the footprint as a simplistic positive or negative mark, the footprint could be more abstract, perhaps showing various product decisions and their tensions or even sensitivities as opposed to a decision as good or bad, perhaps coloured and shaped by the community's discussion on any given material - value linkage. Such a tool could live as an IOT object itself, or float on a mobile app or desktop. The visualisation element could

be physical or digital. In either case, the visualisation allows for ongoing awareness, a prompt for discussion, and calls for ongoing care.

Limitations: While this idea allows for input and visualisation, as well as a social understanding of possible dilemmas, it does not yet incorporate or structure discussion within the company on given choices. However, the simple mechanisms certain allow for more building in the control interface - for example, commenting on certain areas, considering impacts not only to your product itself in terms of value-material choices but also on a different scale of impact (social / economic etc.) by simply using an interface design technique of zooming out to another level of interaction and therefore reflection.
Finally, as IOT developers and designers often model their products in terms of input, output and connections between, this sort of metaphor and its corresponding footprint as an "output" is a tactical advantage.

The Long Game: multiplayer storytelling

Concept: With a very similar foundational dataset of community-gathered and expert analysis as well as legal cases, we could use the framework or mechanism of a long-term game. The game structure could follow similar question lines as the Ethical Footprint - what are your stated values, what are your material decisions - but would allow for a multi-player mindset and storytelling.

Limitations: game frameworks often lend themselves to a traditional points-based winner / loser mentality. We would look for a different orientation of the game, rather than necessarily foregrounding winning and losing. Instead, we would allow for the complicated and even ambiguous understanding of how a product, its creators and their overall company is doing in relation to their stated ethical values. A game framework also allows for more imaginative depiction of second-tier or more system-level impacts, enabling more immersive speculation. Similarly to the Ethical Footprint, it would be an experience that would develop and evolve over time.

7.1.5 Open prototyping based on the VIRT-EU practical framework for ethics

As part of our work to engage with ethical concepts in practical ways, we also plan to run a series of open prototyping sessions with project members and with designers and developers more broadly. The statements that will drive our prototyping process are the following:

1. Considering the logic of care v. the logic of choice[75] - in relation to your product
    a. + “you’re not alone”
2. Structure within a structure[76]
    a. No matter your ideals, what is your capability as imposed by your structure? Therefore you have certain affordances.
    b. And, the product you design will also afford certain opportunities and close off others
3. Certain values underlie that core conception of a product

[75] Mol, 2008
[76] Nussbaum, 2011; Sen, 1999

a. This core is shown as underneath the threshold (the limit of what you would allow to be changed)[77]
b. The values are influenced by your social milieu[78]

Using key aspects from our practical framework for ethics for dealing with IOT design - as well as imaginative prototypes that we will have made to help creators engage with these abstract and complex theories. These prototypes will be the seeds for continuation towards a full set of tools for IOT creators. Some may end up as a branch that becomes tangentially important, some may directly be part of an end product (that will be put in testing in June 2019).

8 Engaging with developers and disseminating in-progress results

8.1 Dissemination

As detailed in the annual report, dissemination and communication of the project results is aimed towards a set of diverse audiences: the scientific and technological communities, citizens, policy makers, entrepreneurs and other scholars.

The impact of VIRT-EU is being maximised through the project's embedded road map, which ensures for proper integration and widespread use of project deliverables, targeted management, complemented by adequate dissemination and exploitation of project results and proper development of intellectual property.

As a matter of knowledge engagement and wide dissemination, project partners ensure that sessions and conferences supported by the project involve practitioners as well as academic researchers. Training of young scholars is a particular area of focus for the project, as we aim to not only engage with young scholars through event organizing but also through active development of teaching curricula.

The VIRT-EU dissemination strategy retains its central commitment to ensuring that project results are broadly disseminated to IoT developer communities, interested stakeholders and policy professionals as well as to the academic community.

8.1.1 Development and maintenance of the VIRT-EU online presence

The Virt-EU website has been through a redesign and restructuring that has improved its visual appearance and navigation. The website can be reached through the following link: https://virteuproject.eu/.

The website's interactive components have expanded with embedded MEDIUM and LinkedIn widgets. The Timeline has been removed from the results section, and a new section oriented towards IoT

[77] Nussbaum, 2011
[78] MacIntyre, 2007

developers and designers, as well as the general public has been added. The Virt-EU website is well-visited with a notable mean of 9.4 daily unique visitors from 104 different countries.

There are no changes in the planning for the second year of the project where a series of blog-posts and social media presence is planned to make sure that the results are made available as they are produced.

8.1.2 Social media presence and public communication through blogging

Virt-EU continues to maintain an active presence on social media communication channels Twitter and Facebook. The Twitter account (@VIRT_EU) has increased its followers to 446, 688 mentions and thousands of views. Similarly, the Facebook (@VIRTEU) has expanded to 64 posts, 41 likes and 42 followers. The advisory group members, researchers and partners have been active in channeling the online discussion around Virt-EU increasing the extent of the project's social media presence where both the participants and the audience are active users.

The Virt-EU blog documents the researchers' public talks, panels and discussions. Since the submission of the annual report 8 blog-posts have been produced. Furthermore, a MEDIUM account (virt-eu) has been set up to enhance dissemination of our informal essays and posts oriented towards non-academic audiences. The MEDIUM account is well-visited and the posts are frequently viewed with approximately 15 views per day.

9 Academic publications and dissemination

Virt-EU partners produced a significant amount of published work and participated in various conferences representing the research and results detailed in the Dissemination Plan **(D7.1)**.

Accepted journal publications

Mantelero, A. (2018). AI and Big Data: A blueprint for a human right, social and ethical impact assessment. *Comp. Law & Sec. Rev*. (forthcoming)

Vega D'Aurelio, D., & Magnani, M. (2018). Foundations of temporal text networks. *Applied Network Science*. (forthcoming)

Brodka, P., Chmiel, A., Magnani, M., & Ragozini, G. (2018) Quantifying layer similarity in multiplex networks: a systematic study. *Royal Society Open Science journal.* (forthcoming)

Gandy Jr, O.H. and Nemorin, S., (2018) Toward a political economy of nudge: smart city variations. In: *Information, Communication & Society*, pp.1-15.

Mantelero, A. (2017) The Guidelines of the Council of Europe in the context of the European data protection framework. In: *Computer Law & Security Report*, vol. 33 n. 5, pp.

Mantelero, A. (2017) Towards a Big Data regulation based on social and ethical values. The Guidelines of the Council of Europe. In: *Revista De Bioética Y Derecho*, vol. 41, pp. 67-84.

Brodka, P. Chmiel, A. Magnani, M. Ragozini, G. (2017) Quantifying layer similarity in multiplex networks: a systematic study. In: *Royal Society open science*.

Conference papers published in proceedings

Fatemi, Z., Magnani, M., & Salehi, M. (2018) A generalized force-directed layout for multiplex sociograms. *Proceedings Social Informatics*, (St. Petersburg, Russia).

Afsarmanesh, N. & Magnani, M., (2018) Partial and overlapping community detection in multiplex social networks. *Proceedings Social Informatics*, (St. Petersburg, Russia).

Hanteer, O., Rossi, L., Vega D'Aurelio, D., & Magnani, M. (2018) From interaction to participation: the role of the imagined audience in social media community detection and an application to political communication on Twitter. *Proceedings International Conference on Social Network Analysis and Mining*, (Barcelona, Spain).

Fritsch, E., Shklovski, I. & Douglas-Jones, R. (2018) Calling for a revolution: An analysis of IoT manifestos. *Proceedings of the 2018 ACM Conference on Human Factors in Computing* (Montreal, Canada). ACM

Light, A., Shklovski, I. & Powell, A. (2017) Design for Existential Crisis in the Anthropocene Age. C&T '17 Proceedings of the 8th International Conference on Communities and Technologies.

Light, A., Shklovski, I. & Powell, A. (2017) Design for the existential crisis. In alt.chi Extended Summarys of the Proceedings of the 2017 ACM Conference on Human Factors in Computing. (Denver, CO, 2017). ACM. Best of Alt.CHI Award

Gandy, Jr. O. H & Nemorin, S. (2017) Neuroeconomics, behavioral economics, and the political economy of 'nudge'. Paper presented at the IAMCR 2017 Conference in Cartagena, Colombia.

Submitted journal & conference papers under review

Powell, A., Moral Orders in Contribution Cultures. Submitted to *Communication, Culture and Critique.*

Nemorin, S. and Powell, A., Social Milieu and Ethical Technology Design: Insights from Internet of Things developers. Submitted to *Ethics in Information Technology*.

Nemorin, S. Sensor sensibility: IoT's Imperial inheritance and the techno-colonisation of the Global South. Submitted to the *8th Biennial Surveillance Studies Network / Surveillance & Society Conference*, Aarhus, Denmark.

Demetzou, K., Böck, L., Hanteer, O. Smart Bears don't talk to strangers: analysing privacy concerns and technical solutions in smart toys for children. Submitted to the *PETRAS Living in the Internet of Things Conference*, London, UK.

Journal papers in process

Nemorin, S., Powell, A. Lehuede, S and F. Ustek-Spilda, A virtues-based approach to making sense of ethics in IoT.

Powell, A., Shklovski, I., Rossi, L., Magnani, M., Mantelero, A., Douglas-Jones, R. Why ethics in IoT needs an interdisciplinary inquiry - the VIRT-EU approach.

List of keynotes, conference talks and presentations

Alessandro Mantelero. Pisa, (June 8-9, 2018). *La gestione del rischio nel GDPR: limiti e sfide,* L'entrata in vigore del Regolamento (UE) 2016/679: la riforma alla prova della prassi in Italia e in Spagna - 1° Incontro di studi italo-spagnolo in materia di protezione dei dati personali, University of Pisa.

Alessandro Mantelero, Alison Powell, Irina Shklovski & Javier Ruiz. Copenhagen, (May 17-18, 2018). *Values and Ethics in the Design and Governance of IoT: Towards a Privacy, Ethical and Social Impact Assessment, PESIA).* Information Ethics Roundtable conference, University of Copenhagen.

Alessandro Mantelero. Geneva, (February 19-20, 2018). *New and emerging issues: The collective dimension of data protection and the tools to safeguard it, Privacy, Ethical and Social Impact Assessment),* Expert workshop on the right to privacy in the digital age, OHCHR - Office of the United Nations High Commissioner for Human Rights.

Alessandro Mantelero. (May 3, 2018). Workshop on risk assessment and security measures for personal data processing, ENISA - European Union Agency for Network and Information Security.

Alessandro Mantelero. Rome (February 8, 2018). Towards an effective approach to risk assessment in data processing. Workshop on security of personal data processing, ENISA - European Union Agency for Network and Information Security.

Alessandro Mantelero. Bruxelles (January 23, 2018). *The Internet of the human body: towards a habeas data?* European Parliament, European Parliamentary Research Service.

Alison Powell. *Values and Ethics in the Design and Governance of IoT.* London (March 23, 2018). PETRAS conference - Cybersecurity of the Internet of Things, IET London.

Alison Powell. *The Virt-EU Approach (workshop presentation within workshop on design as object and method)* Prague (May 24-28, 2018). Annual ICA Conference. International Communications Association, Hilton Prague Hotel.

Alison Powell. *Ethics and Activism: The City as a Platform.* New Orleans (April 17, 2018). Latest in research and applications in geography, sustainability, and GIS science. American Association of Geographers Conference, Sheraton New Orleans Hotel.

Maria Samantha. Pisa, (June 8-9, 2018). *L'impatto del trattamento su diritti e libertà alla luce della giurisprudenza delle autorità garanti italiana e spagnola.* L'entrata in vigore del Regolamento (UE)

2016/679: la riforma alla prova della prassi in Italia e in Spagna - 1° Incontro di studi italo-spagnolo in materia di protezione dei dati personali, University of Pisa.

Matteo Magnani, Luca Rossi & Obaida Hanteer. Utrecht (June 2018). Analysis of multiplex social networks with R. SunBelt Conference, Utrecht University.

Shklovski, I. Amsterdam, (January 2018) *Responsible Research and Innovation: Thinking About Minimum Core Obligations in Design*. Invited keynote at the CANDID closing conference. Waag Society

Shklovski, I. Copenhagen, (May 2018) *The Internet of Things: A question of ethics.* Invited talk at the Centre for European and Comparative Legal Studies, University of Copenhagen.

Shklovski, I. Copenhagen, (April 2018). *The Internet of Things: Ethics, Security and Other Troubles.* Keynote at the IDC Internet of Things 2018 Conference.

Virt-EU supported and organized events

Virt-EU co-creation workshop. Amsterdam (March 22-23, 2018). The workshop was composed of IoT developers, designers, manifesto authors, and startup founders. It was designed and organized by CIID in collaboration with ITU and ORG.

Virt-EU co-creation workshop. London (May 9-10, 2018). The workshop was composed of IoT developers, designers and CEOs from small companies or startups. It was designed and organised by CIID in collaboration with ORG and LSE.

IoT Day. Copenhagen (April 9, 2018). IoT day was organized by VIRT-EU in collaboration with EthosLab. Irina Shklovski and Rachel Douglas- Jones delivered talks on the VIRT-EU project and Manifesto papers. IT University of Copenhagen.

Other dissemination activities – blog posts on the VIRT-EU website

A Time of IoT Manifestos (in Europe). Following the paper *Calling for a Revolution: An Analysis of IoT Manifestos* the work of VIRT-EU researchers shows that the manifestos mark a specific point in the conversations about ethics and IoT. - written by Irina Shklovski, Rachel Douglas-Jones and Ester Fritsch (ITU) May 29, 2018

IoT Day Copenhagen - What kind of future do we want to live in? Virt-EU co-organized IoT day in collaboration with EthosLab at the IT University of Copenhagen. The event guested lecturers and industry members participating in a talk on Virt-EU and Manifesto papers by Irina Shklovski and Rachel Douglas-Jones followed by interactions with Alexa and Google Home. - written by Inda Memic (ITU) May 8, 2018

Dowse Workshop. Virt-EU hosted a Dowse workshop run by Jaromil and Federico Bonelli from dyne.org co-organized by IT University of Copenhagen, IDA and CIID. The workshop was the first open-ended activity in the co-design line of work of VIRT-EU to explore the potential to create and

reflect upon tools that make the domestic internet of things more visible to the end user. - written by Annelie Berner (CIID) and Ester Fritsch (ITU) March 19, 2018.

Regulating the "Internet of Flying Things" - Security by design and the deployment of IoT connected drones in smart cities. Virt-EU researcher Selena Nemorin addressed the issues of design and regulation of drones as part of connected systems. - written by Selena Nemorin (LSE) March 5, 2018.

ThingsCon Salon Copenhagen - TechFestival. VIRT-EU co-hosted an Ethical and Responsible IoT event in collaboration with ThingsCon - Europe's leading conference about the future of hardware, connected devices and IoT. The event was designed as a "Meetup" which brought designers, developers, legal professionals, and members of the curious public into dialogue for an evening. - written by Rachel Douglas-Jones (ITU) February 22, 201810 Project management

10 Project management

10.1 Overall management practices and risk contingency planning

The project management structure established in the first month of VIRT-EU continues to prove efficient and adequate for aligning with the need to plan, manage and control project activities of WP-leaders, Task-leaders and the Project Coordinator.

Since the submission of the annual report there have been no changes in the structure. All WP-leaders and project partners remain highly involved in scientific or technical tasks in a cross-disciplinary and collaborative manner.

The project coordinator assures strong project management and day-to-day organization through various tasks and responsibilities assigned by the consortium members. The tasks and responsibilities include:

Monitoring compliance by the Partners with their obligations– Since the submission of the annual report many online meetings and several in-person meetings have been conducted. The timing from previously planned meetings has been met except for a few adjustments outlined in Table (…). There have been no breaches of agreement and all obligations have been completed as expected.

Resolution of any potential partnership instability and conflict- No instability and conflict has been observed within partners.

Organisation of the in-person consortium meeting in May 2018– The all-consortium in-person meeting was planned by the ITU. It allowed project members to develop a joint practical framework for rooted in the ideas of responsible research and innovation (RRI) in action assuring that project progress is measured against success criteria.

Coordination of technical activities and work flow plan within work packages– the coordination of technical and scientific activities has been conducted through monthly online meetings, deliverable management and other project activities. Various mediated communication media have been applied to ensure project-specific real-time communication and a well-managed workflow.

Adoption of change-control procedures for the work-plan as needed– Procedures and work-plan alterations have been discussed at the monthly online consortium meetings and agreed upon by all members. Since the submission of the annual report there have been no adjustments concerning the selection of quantitative data sources and qualitative field-work sites.

10.1.1 Communication and project meetings

Project partners rely on a combination of regular online consortium meetings, in-person plenary meetings, in-situ working meetings, coordination, sharing of interesting content, event announcements and ad hoc discussions.
As described in the annual report following services support communication among VIRT-EU project partners:

- An official mailing list for project partners to exchange ideas
- Podio - functional project management and progress tracking
- Rocket.Chat - open source secure real-time communication system run by the ITU
- Dropbox - commercial system used for sharing administrative content, publication drafts, deliverable drafts, publicity content and drafts of social media communication
- OwnCloud - secure ITU implementation currently used to share ethnographic material, accessible only to consortium members
- Zotero - open source system used to share relevant literature and citations to ensure that all members have access to the primary literature
- GoogleDrive - used for collaborative creation of deliverable documents and other types of co-written content
- AdobeConnect - ITU-managed implementation to conduct remote WP and project meetings.

Since the submission of the annual report several in-person meetings and one all-consortium in-person meeting have been held to ensure progress in interdisciplinary collaboration. Planned and completed physical project and plenary meetings are detailed in the table below. Partner sub-groups have organized in-person meetings as needed.

Meeting type	Date	Venue	Additional details
Qualitative-Legal team meeting	January 2018	Brussels	*Project meeting – discussion about the intersections between the legal, policy and qualitative research outputs.*
2nd plenary meeting	May 14-15, 2018	ITU, Copenhagen	*An all-consortium in-person meeting* – Conducted as part of the planned task 3.5-4.5 this all-consortium meeting focused on interim empirical data synthesis with legal research development and resulted in the foundation for the VIRT-EU practical framework for ethics developed together by all partners.
3rd plenary meeting	September 2018	Brussels	*Planned meeting* - in conjunction with 18-month EU project review.
4th plenary meeting	January 2019	Torino, Italy	*Planned meeting* - completion of the main phase of empirical data collection and consolidation of results.
5th plenary meeting	June 2019	London, UK	*Planned meeting* - in conjunction with Advisory board meeting and Public Design Challenge
Final plenary meeting	November 2019	Copenhagen, Denmark	*Planned meeting* - prior to project end (in conjunction with closing conference)

Table 2. Overview of project and plenary meetings (other meetings may be planned as needed)

10.1.2 Open access and open research data management

Virt-EU is committed to open access to research data and scientific publications as part of Horizon2020. Quantitative and qualitative data sharing within consortium is managed by independent secure systems. The majority of exchanges between consortium members involve aggregate level data where individual level data exchanges are conducted through the use of encryption.

Identifying information and sensitive data will never be shared publicly as detailed in **D1.6.** Only selected data of scientific relevance is openly shared. VIRT-EU is committed to an open-access policy. All publications, reports and deliverables produced by the project are made available on the project website.

10.1.3 Deliverables and Milestones completed by M18

Deliverables WP1						
Num.	**Name**	**Lead**	**Type**	**Level**	**Due date**	**Submitted**
D1.1	Management and Quality Plan	ITU	R	PU	M02	Feb 28, 2017
D1.2	Annual Report	ITU	R	PU	M12	Jan 31, 2018
D1.3	Mid-term report	ITU	R	PU	M18	July 16, 2018
D1.4	Project final report	ITU	R	PU	M36	Pending
D1.5	Innovation and Open Access Management Plan	ITU	R	PU	M03	Mar 31, 2017
D1.6	Open Research Data Management plan	ITU	R	PU	M06	Apr 28, 2017

Milestones WP1			
Num.	**Name**	**Estimated date**	**Means of verification**
M1.1	Detailed implementation plan approved by the consortium and ready to implement	Achieved 02/2017	Document/ Gantt chart
M1.2	Mid-term report and progress evaluation	M18	Public report – completed in M19
M1.3	Final deliverables and reports	M36	Document

Table 3. Deliverables and milestones for WP1

Deliverables WP2						
Num.	**Name**	**Lead**	**Type**	**Level**	**Due date**	**Submitted**
D2.1	Blog posts and multi-media material summarizing preliminary empirical and policy findings for developer communities under study and other interested stakeholders, disseminated through a variety of social media channels	CIID	DEC	PU	M9	Sep 30, 2017
D2.2	Revised and extended summary of integrated qualitative and quantitative findings, legal analysis and plans for further research activities in WP3 and WP4	LSE	R	PU	M11	Dec 1, 2017

Milestones WP2			
Num.	**Name**	**Estimated date**	**Means of verification**
M2.1	Initial multiplex network of collaboration and co-attendance	Achieved 09/2017	Internal report

Table 4. Deliverables and milestones for WP2

Deliverables WP3					
Num.	**Name**	**Lead**	**Type**	**Level**	**Due date**
D3.1	Technical report with the definition of the adopted network analysis metrics, code and quantitative analysis	UU	R	PU	M28
D3.2	A series of blog posts and multi-media reports about interim empirical findings disseminated to the IoT community	LSE	DEC	PU	M21
D3.3	Prototype tool concepts produced from co-creation workshops	CIID	DEM	PU	M28

Milestones WP3			
Num.	**Name**	**Estimated date**	**Means of verification**
M3.1	Metrics for network data analysis defined and implemented	Achieved 02/2018	Internal report

Table 5. Deliverables and milestones for WP3

Deliverables WP4						
Num.	**Name**	**Lead**	**Type**	**Level**	**Due date**	**Subm.**
D4.1	First Report: This report to the internal members of the consortium is the synthesis and analysis of the findings of Task 4.1	POLITO	R	PU	M12	Dec. 28, 2018
D4.2	Social media communication with an overview of the key elements of the PESIA	ORG	DEC	PU	M20	Pending
D4.3	Second Report: This report to the internal members of the consortium describe the PESIA methodology and provides	POLITO	R	PU	M24	Pending
D4.4	Final report on PESIA and related guidelines and questionnaires	POLITO	R	PU	M30	Pending

Milestones WP4			
Num.	**Name**	**Estimated date**	**Means of verification**
M4.1	An initial definition of the PESIA methodology	Dec 2017	Internal report
M4.2	An initial overview of sector-specific issues concerning the application of PESIA	M20	Internal report

Table 6. Deliverables and milestones WP4

Deliverables WP7						
Num.	**Name**	**Lead**	**Type**	**Level**	**Due date**	**Subm.**
D7.1	Revised Dissemination Plan approved by the consortium and ready to implement	POLITO	R	PU	M02	Feb. 28, 2017
D7.2	VIRT-EU gateway (a dedicated section will serve as open- access data repository)	POLITO	DEC	PU	M03	Mar 31, 2017
D7.3	Local Briefing Sessions: (one per each year at three different locations), Opening and Closing Conference	POLITO	DEC	PU	M30	Pending
D7.4	Curriculum development material accumulation	POLITO	R	PU	M24	Pending
D7.5	Initial publications in peer reviewed journals and conference proceedings, according to the criteria of the dissemination strategy	POLITO	R	PU	M18	Achieved 07/2018
D7.6	Open-access data repository: Research material to be submitted to identified developer community open access data repositories. Includes archive of co-design outputs, videos, infographics, digital visualizations, scenarios and tools produced in **WP6** and **WP7**	POLITO	DEC	PU	M36	Pending

Milestones WP7			
Num.	**Name**	**Estimated date**	**Means of verification**
M7.1	Detailed Dissemination Plan approved by the consortium and ready to implement	Achieved on 02/2017	Internal report
M7.2	Launch project website	Achieved on 01/2017	Public event

Table 7. Deliverables and milestones for WP7

10.1.4 Substantive work packages anticipated in M18 – M36

WP 5 Data Synthesis and Tool Development – M18-M34
WP5 is composed of two parts. The first entails analytically and methodologically combining the network defined in **WP3** with the qualitative information from the field sites and co-design workshops in **WP3** and legal analysis development in **WP4**. In this work package, all VIRT-EU partners will perform comparative analysis of the four types of data. More specifically, enactments of ethics with respect to data and privacy will first be identified and categorized and then connected to legal concepts and privacy and data protection by design guidelines. Then, these notions will be mapped to the corresponding network locations of IoT developers to enable a comparison of the network structure, innovation position, and the diffusion of the cultural notions. **WP5** activities will be to our knowledge, among the first systematic attempts to investigate the problem of propagation of ideas and concepts through extended ethnographic research with network members combined with a multiplex network analysis.

The second part of **WP5** turns research findings into actionable outputs directed towards the community under investigation and European policy makers and stakeholders. **WP5** develops recommendations and strategies for IoT developers handling issues of data and data use in a format that ease integration into the developer community through involving them directly in the design of the outputs. Three main types of outputs will be developed, namely:

- A set of scenarios that will enable developers to interrogate best practices in integrating ethical decisions about data processing into their own design practices.
- A set of guidelines to embed ethical and social impact assessment in the process of device design.
- A set of tools to enable ethical and social impact self-assessment in the course of development processes.
- A set of scripts/scenarios oriented toward developers as well as activists, civil society, non-profit organizations and others invested in developing a common ground through discussion of issues such as privacy and data protection with regards to the ethics of data-intensive and personal sensing technologies.

Work package objectives for **WP5** have been defined as follows:

1. Develop new methodologies for achieving analytic synthesis of qualitative and quantitative empirical data and legal analysis.
2. Identify connections between networked relationships among developers and community processes of idea exchange and enactment of ethics in practice.
3. Develop processes based on the ethical impact assessment framework and study of knowledge sharing and ethical practices to systematically consider and implement privacy, security and ethical frameworks for technology developers and their clients and partners.
4. Develop tools and materials to support developers in negotiating, articulating and acting on shared ethical values and to support interdisciplinary interaction among a range of stakeholders for addressing these issues.

WP 6 Took and Scenario Evaluation and Effect Measurement – M27-M36

WP6 will refine and finalize tools, scenarios, guidelines and scripts initially defined as outputs of **WP5**. These tools, scenarios, guidelines and scripts will then be offered as tools and materials to the developers delivered via the project website, ORG website and publicized through their networks and through the networks of the Advisory Group. At the same time **WP6** will also lead the evaluation of the impact of the project through the development of a set of quantitative measures of structural change in developer communities under study. **WP6** will include a public design challenge that will take the form of a competition to utilize PESIA tools and to produce a prototype or proof of concept that addresses one the scenarios developed in **WP5**. This is a significant and unique opportunity for integration between policy and practice, establishing an open process in an area where this kind of reflection has been lacking. Finally, **WP6** will use quantitative and qualitative measures developed in **WP3** to assess impact in developer communities.

Work package objectives for **WP6** have been defined as follows:

1. Develop a usable set of tools and materials based on the PESIA framework to be deployed to the broader community of developers and other stakeholders.
2. Evaluate the tools and materials produced by the project through co-design and co-creation with relevant communities.
3. Develop specifications for the use of project outcomes as a service to the developer communities and other stakeholders delivered via ORG website.

4. Demonstrate project effectiveness through quantitative measures of structural and qualitative changes resulting from project-lead interventions in developer communities under study over the course of the project.
5. Demonstrate effectiveness of tools and methods through a direct engagement with the IoT developers, makers and community innovators via a design challenge event.