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Addressing Dilemmas Through Design Fiction**

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# Near Future Cities of Things: Addressing Dilemmas through Design Fiction

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**Abstract**

The smart city infrastructure will soon start to include smart agents, i.e., agentic things, which co-exist and co-perform with human citizens. This near-future scenario explores the flexible types of collaborations and relationships between the human and nonhuman citizens. Drawing on current technology forecasts and AI/robotics literature, we created five fictional concepts for reflecting on themes we deem important for such collaborations: responsibility, delegation, relationship, priority, and adaptation. The promises, challenges and threats of these themes are discussed in this paper, together with the new questions that were opened up through the use of design fiction as a method.

**Author Keywords**

Design fiction; future scenario; smart cities; co-performance; agentic things; dilemmas.

**ACM Classification Keywords**

H.5.m. Information interfaces and presentation: Miscellaneous.

**Introduction**

The smart cities operate with sensors embedded in the urban infrastructure to collect all sorts of data, a digital

layer that helps monitoring and quantifying various aspects from space, energy, traffic, resources, and so on. Current technologies, however, are pushing urban innovation beyond the collection and visualization of data. Everyday things around us started to get smarter, with capabilities to sense and act autonomously, learn and evolve. Things are becoming *agents* with performative roles in our lives [10]. In the next iteration of the smart city concept, these agents might become a part of the city infrastructure, work in concert with people and influence the environment. In this paper, we refer to these as “agentic things”, namely data-enabled artifacts with performing capabilities [17], which are able to connect with existing networks of data, collect real time data, act proactively, and potentially behave socially. And we suggest a vision of a city as “an assemblage” of agents, both human and non-human [12], rather than a sensing dashboard. This concept of human-nonhuman assemblage and co-performance among different agents are the object of investigation of the PACT research program, a collaboration between the Faculty of Industrial Design Engineering at TU Delft and the Amsterdam Institute for Advanced Metropolitan Solutions (AMS). This research is aimed at developing novel methods and tools for understanding and demonstrating how collaborations could be built between cities, citizens, and agentic things to generate, prototype, and validate design hypotheses for flexible and responsive urban infrastructures. Given the aim of the project, we used design fiction as a way set the stage for discussion and identifying relevant questions and controversies that may arise from the coexistence of humans and agentic things. We crafted a future scenario by mapping forecasts, reviewing relevant literature as well as news, for envisioning possible

types of interactions and controversies in a near future smart city. The presented design fiction enabled us to speculate and reflect on five prominent classes of dilemmas we deem important for such collaborations — *responsibility, delegation, relationship, priority, and adaptation*. Design fiction allowed us to dive deep into these issues before the change will actually happen and to ponder upon its promises, challenges, and threats.

### **Background and related work**

Interest is growing in the HCI field regarding the new capacities for action that are configured at the intersection of humans and nonhumans [e.g. 13; 23; 37; 47; 51]. We argue that design fiction [48] and fictional “things” offer a way to reflect on the entangled character of agency in the context of smart cities. It is important to note that the role of design fiction is “not to show how things will be but to open up a space for discussion” [14]. Situating a new technology within a fiction forces the readers to grapple with questions of ethics, values, social perspectives, causality, and politics [50]. This “discursive space” opened up by design fictions allows one to discuss and explore future technologies in a context [21]. We can also envision how technologies not yet here (but soon to come) could be used in everyday life, how they could be discussed and what kinds of meanings, feelings and values people could attach to them. As Gonzatto and his colleagues aptly suggests that design fictions “are not disinterested speculations about distant futures, but intentional practices in the present time” [20]. When it comes to the agency of things, fictional influences have proven to play an important role for its development. In his manifesto for networked objects, Bleecker [5] prepared us for objects developing a form of agency through the use of Internet as a means to gain

sentience. Van Allen and McVeigh-Schultz [52] used animism as a metaphor to build ecologies of interactive objects with designed behaviors in order to express the system's designed intentions, affordances, expertise and history, and thus enable fluid relationships between humans and interactive systems. Auger [2] used a speculative design approach to ask how robots could become domestic products and created environments that are adapted to the robots' way of functioning instead of the other way around. Dunn and Raby [15] explored through a design noir approach how robots become cohabitants in daily life and the ways they could relate with us. Kirman and his colleagues [27] present a speculative vision of an evil robot controlled future, in order to reframe and inspire reflection on long-term consequences of contemporary HCI research. Using fiction and narrative is not new in the design research field, but what is new is that fictional practices are now being considered as viable pathways for producing valid knowledge in design research [33].

Design fiction represents a speculative mode of thinking that can open up new questions and unfamiliar opportunities. The fiction presented in this paper investigates the possible personal, social and cultural consequences of near future smart cities where humans and nonhumans co-perform. The design concepts, that characterize the scenario presented in the next section, are aimed to prompt reflection beyond the things themselves to wider societal issues they will bring.

### **Future scenario: Amsterdam 2040**

Amsterdam, 2040. Agathe (A), an eighteen years old girl from a rural island in the Mediterranean Sea, just arrived in the city where she is going to study to become a teacher. The Netherlands, in fact, have a

long history in education and, in the last twenty years, the Dutch children have been rated among the happiest in the world. Beyond this motivation, Agathe chose to move to Amsterdam because it is renowned for being an innovative, efficient and lively city. Since 2020, in fact, the city has invested in new applications of AI and robotics for addressing some of the most relevant challenges of what (at that time) were called "smart cities", aiming at becoming a model also for other countries.

For about 10 years, the city administration has been extremely active in terms of management and regulation of autonomous services for public transport, delivery of goods, public cleaning, security, and health protection. By defining flexible regulations, Amsterdam became a playground for novel autonomous services. These, however, did not come without consequences. Regarding the transportation systems, for instance, the Netherlands saw the first wave of autonomous vehicles around 2020, when many companies launched their first commercial vehicles. This development raised a big public debate on the themes of safety and ethics. In fact, few years before one of the first autonomous cars accidentally crashed and killed a man in the United States and several smaller accidents occurred after. But the reliability of these vehicles increased dramatically since then. And what made the city really innovative was the act of banning the access to the central areas to private vehicles in 2030, encouraging the use of shared and on-demand services. Other autonomous services experienced also a similar trend. As a result, in 2040, the citizens of Amsterdam are used to the presence of nonhuman cohabitants.

The following conversation reports the first impressions of Agathe about the city, while she is talking with her mother (M):



**Figure 1:** One of the streets of Amsterdam where Agathe walks every day to go to the university.

"(A) Hey mom, Amsterdam is great! This city is a mix of historical buildings and technology embedded in many services. Everything looks efficient, organized and clean."

"(M) Oh, I'm so happy to hear that! But, are you safe? It's a big city...You have to be careful on where you walk alone..."

"(A) No mom, you have no idea! I can go everywhere I want. The city has a system for protecting people safety. Basically, they created this fleet of drones that detect the people who might be at risk... Depending on which street it is, what time it is, if there is enough light... Many things... and if they find like a girl, an old person or a kid, who is walking alone in the night, one drone "walk" with her or him... and it is so up in the air that you don't even hear much noise..."

"(M) Really? But, wait... How does it actually protect a person?"

"(A) Well... I searched online about that...So, each drone has a camera, a microphone and a speaker, which can detect if something strange or dangerous is happening... In the case of danger, the police receive an emergency call. But in the meantime, the drone also starts also to make a huge noise to alert people. And in most of cases, they say, this is enough to make the criminals to go away."

"(M) Oh... I see. That sounds...interesting... But tell me about something else. Is it really as clean as everyone says?"

"(A) Yes mom it is so cool! They have these robots that go around all the time... They can take solid waste, like... cans, or paper that sometimes tourists leave around. And it's not just that! These things are also made for reducing pollution. At their bottom part, they have a sort of reel that take off those fine particles of pollution that remain on the ground. And on top, there is a sort of cylinder that, I have no idea how, purify the air just being in contact with it..."

"(M) That's interesting... Sounds a little bit like a magic to me..."

"(A) ahah no mom, I don't think that it's such a big deal... it must be somehow similar to the robot that we have at home...with the only difference that these work in groups"

"(M) Well...maybe you're right! Anyway, how is the food? Do you need me to send you anything?"

"(A) No mom! Don't be silly! It's not like when you were young. I can find any kind of food here. And you know what? A super funny robot can bring it to you!"

"(M) A funny robot?"

"(A) Well... Yes, these robots are super sociable and nice! They ask you how you feel and if you are satisfied with the delivery, they make funny jokes...and if you meet them in the street they are very polite and try their best not to annoy you."

"(M) Why robots would ask you how you feel and make jokes? Isn't it silly?"

"(A) Well... I think that the company that manage them wants to offer the best customer experience... So, this question is a way to assess the satisfaction of the clients and maybe to adjust their service"

"(M) That sounds reasonable. So... No box with olive oil or something else? Are you sure?"

"(A) ahah no mom, please!"

"(M) All right, all right... And how do you go to the University? Is it far from your apartment?"

"(A) Well... Yes, it is quite far...I spend around 30 minutes on the bus. But the busses are too cool! It's not just that they are autonomous, electric and so on... I mean, of course... But you

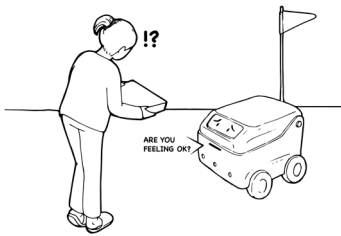


Figure 2: Agathe taking a pizza from a delivery robot.

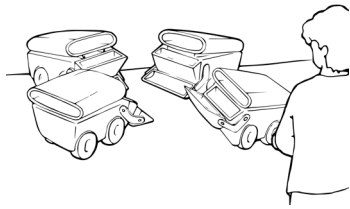


Figure 3: A boy looking at a group of cleaning robots.

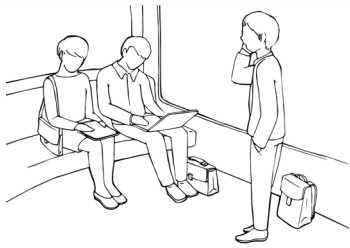


Figure 4: People working on the bus.

can even ask to be picked up at your place... You don't necessarily need to go to the bus stop."

"(M) Oh, really? It must be expensive... and there must be a lot of traffic!"

"(A) No, no, no! It's actually quite organized! My roommate told me that the municipality of Amsterdam has banned the access of private vehicles to the city in 2030, following the example of Oslo, that did it a few years before. But you can still go everywhere with the bikes of course."

"(M) That sounds beautiful!"

"(A) Yes, it is! And the busses have never the same route, because it is calculated everyday according to the traffic data and other things... like... for instance, if there is a big event at the stadium, the busses will all avoid it, unless the people in the bus really have to go to the stadium."

"(M) I see... And what about people? Do you like your roommates and your colleagues at the University?"

"(A) My roommates are nice and they keep the rooms decently... Well, maybe not all of them. And the other students at the university are also nice, I don't know many people yet... But the funny thing is that many people here wear a sort of strange wearable device... It is a thing in between a scarf and a big neckless... and it's made for protecting health, or something like that..."

"(M) Yes of course, you always have to keep yourself warm... and with that weather it's even more important!"

"(A) But no mom! It's not really made for keeping you warm... It's a shape-changing device that match environmental data with the data from your body, and if it's needed, it protects you by becoming a mask, a helmet, headphones or a sort of a sleeping bubble."

"(M) Mmm... this sounds strange! How can it become a mask? And why should it do that?"

"(A) Well, I don't really know how it works in the details, but there should be some kind of inflatable elements inside that can make it expand just one part. And it's made for protecting people from pollution... So, if you are walking in a polluted area, it detects it and changes shape."

"(M) I thought that the Netherlands is not polluted anymore."

"(A) It is not very polluted, like other countries... But they say that the continuous exposure to pollution, even if in small percentages, is the cause of many health issues. So, with these wearables and the cleaning robots they are basically reducing the problem and saving money for health services."

"(M) Well, I'm very happy that you chose that city... It sounds great! I really look forward to visiting you this summer."

"(A) Yes! You will like it!"

After living few weeks in the city, Agathe started being a little critical and in another conversation with her mother, she starts questioning the appropriateness of those services that she greatly appreciated when she arrived:

"(A) You know mom, everything is organized and efficient. But... I don't know... Some things look weird to me..."

"(M) Oh I'm sorry to hear that, don't you like being there anymore?"

"(A) No, no, no...I love it, but..."

"(M) But?"

"(A) Well... Take last night...I ordered a pizza and one of those "friendly" robots delivered it... Yes, it was nice, positive and careful as always... But... When I took my pizza, the robot told me 'So...no margherita this time! Don't you like it anymore? Are you sick?'"

"(M) Sick? Are you sick? Shall I worry? Why did it think that you might be sick?"

"(A) No mom, I'm not sick...I have no idea why I should be sick... Maybe because there was no cheese on the pizza I choose... But that's not the point... the robot is keeping track of my pizzas..."

"(M) Well... You know, it was like that even 20 years ago... But the only difference is that we were not really aware of that..."

"(A) Yeah, I know... But it's strange anyway... Maybe it would be better if it would be just like the cleaning ones... Those are just going around, they don't speak, you cannot really interact... They just avoid you if you are on their way..."

"(M) Yes, but try to take a pizza from a thing that avoids you..."

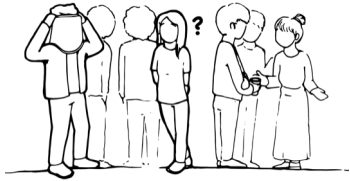


Figure 5: A girl trying to hide from a drone while walking on the street.

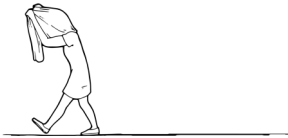


Figure 6: A girl trying to hide from a drone while walking on the street.

"(A) ahah I know... and even those, in the end, are a little bit creepy sometimes... For instance, some days ago I came across a guy that I know from the university... He was staring at a group of cleaning robots and I asked him what he was doing. Do you know what he said?"

"(M) What did he say?"

"(A) He said that those robots were there in a group just beeping and slightly moving every once in a while...but they were not cleaning...he stayed there for around ten minutes and he couldn't figure out what they were doing."

"(M) Well... It doesn't sound like a big deal... But a little bit weird though... But, what about the busses? Do you still like them?"

"(A) Yeah, sure, I like them! But there is a funny thing that I noticed. Every day I never really know how long my trip from home to the university will be..."

"(M) And why is that?"

"(A) Well, the path is always calculated on the basis of the destinations decided by the people who take the bus and on the basis of an algorithm that optimizes the traffic, and in the rush hours there are some busses that keep a slower speed while others go faster... So, every time the route is different and you never know if you are in the fast or slow bus..."

"(M) Yes, but... It cannot be too different..."

"(A) No, no... But, you know, sometimes it's enough for making people late for a call, or other work stuff... But you never know for sure... So, some people just leave home earlier, while some others just start working on the bus, which looks like a sort of moving office sometimes..."

"(M) I see... But, is there a way in which you can choose a bus that go faster that day in case one day you really need to be at the university very urgently?"

"(A) No mom... It is not that simple... Everything is calculated in real time and adapt all the time... And then, imagine if you could choose the fast or the slow bus... Everybody would prefer the fast one, don't you think?"

"(M) Yes you are right... But it sounds like people have to be in the mercy of the bus will!"

"(A) ahah! Exactly! But when I look around, people don't seem to care too much about it... Maybe they just got used to it..."

"(M) I guess so... And after all, there is always need for a little spirit of adaptation"

"(A) Of course... but not always... For instance, do you remember that cool sort of scarf for protecting health that I told you about?"

"(M) Yes, what about it?"

"(A) Apparently, sometimes it can be a little bit awkward...I have never worn it, but some people told me that sometimes it changes its shape into things that are not really appropriate for the situation"

"(M) Like what?"

"(A) Well, it is actually funny... Some days ago, I was with some friends hanging out in a park...Mark was talking with Liz, a girl that he likes... Well, suddenly that thing entered in relaxation mode... He was pushing it back to the 'inactive' mode but it was blowing up again... and this relaxation mode is a sort of a sleeping bubble... So, your face is basically hidden in that thing... Well, after a few times that the thing told Mark to relax a bit...he decided to leave...I guess he was embarrassed..."

"(M) Ahah, I can imagine that! But why that thing thought that Mark needed to relax? Can't it understand that it wasn't the right moment?"

"(A) Well, I guess so...I think that the thing must have mixed the sound noise levels with his heartbeat, and who knows... But I'm pretty sure that the heartbeat was caused by his conversation with Liz...Ahah"

"(M) All these things are a little bit weird in the end... What about the drones...I never liked them..."

"(A) Yes mom, maybe you were right... Sometimes I think that they do not really make people feel safer, but rather the opposite...Saturday night, for instance, I saw a girl walking in the street keeping her jacket up to hide herself...and you know... These drones always follow the girls, only sometimes, they follow the guys... But it doesn't really feel good."

"(M) I told you, that was never a great idea... I told you!"

"(A) Come on mom!"

### **Crafting the story**

Amsterdam 2040 is a predictive scenario [32] in which design fiction is used as “*fictional depictions of future technology to tell a story about the world in which that technology is situated*” [50]. Amsterdam was chosen as a context due to the collaboration with the AMS Institute. We crafted the scenario as an extract of a story about a girl who moves in a new context, because a narrative structure is necessary to qualify design fiction as such and to distinguish it from mere speculation [50]. In the story, a brief introduction to the context is given by an external narrator to set the scene. The description of the fictional design concepts, instead, is unfolded through a conversation between the girl and her mother, two characters that are used to present different viewpoints, as in Hanna and Ashby [22]. The first conversation, which takes place when the protagonist first moves to Amsterdam, reflects her enthusiasm and positive attitude towards the new technologies she encountered. The second conversation takes place few weeks later when the enthusiasm has faded, and scepticism is introduced in the narrative. The two dialogues were intended to present two controversial aspects of future things and technologies, i.e. dilemmas, but these are presented without being totally enthusiastic neither sceptical. Although design fictions are commonly used for “*arguing for or against a potential technological future by couching its insight within persuasive narrative structures*” [50], we deliberately aimed not to take any position regarding the potential challenges of the smart city and aimed to present a multifaceted picture of what the future can bring. Auger suggested that the success of design fiction partly relies on the careful management of speculation, that should not stray too far into the future to present alien technological habitats, which may


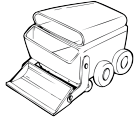



cause the audience to disengage with the proposal [3]. This was another intention in our scenario, where we aimed to present a plausible scenario carrying many familiar elements from today’s Amsterdam and trends.

### **Provocative design concepts**

The concepts (Table 1) were ideated by referring to products and projects that characterize the current rhetoric about the smart city (especially Amsterdam Smart City themes and projects), i.e., security, mobility, quality of the environment, autonomous services and health. The process relied on resources about both current technological trends and scientific literature, with a particular focus on autonomous things. The concepts were used to introduce five themes in the research project, to which relate recurring dilemmas often associated to the spread of autonomous agents. Although these relate to all design concepts, we deliberately matched each theme with one concept for providing a focus on questionable situations and implications. The concepts were crafted only in the form of narration and sketches since design concepts were shown to be usefully discussed without necessarily making them [6].

The first concept focuses on the theme of *responsibility* [1; 36]. Although widely debated in relation to autonomous and learning robots that might behave out of human control [49], near future scenarios might likely need to address more practical questions related to the responsibility in terms of ownership, management and functioning. In the scenario, for instance, we introduced a controversial relationship between citizens’ security and freedom, by rising concerns on discrimination, privacy, trust, and other issue related to data governance [55].



	<b>The national guardian angel drone (1)</b>	<b>The self-sufficient robot cleaner (2)</b>	<b>The friendly delivery robot (3)</b>	<b>The efficient public transport system (4)</b>	<b>The proactive wearable shield (5)</b>
<b>Concept</b>					
<b>References</b>	<p>Current robots for security services (e.g. security robots [34], police drones [31])</p> <p>Scientific literature about robotic systems for surveillance [26] and their legal implications [38]</p>	<p>Current examples of near future cleaning robots, like Enway and A1A3 [40]</p> <p>Scientific literature about robot cleaning systems for public spaces [42; 43], swarm robotics [45] and photo-catalytic air purification [35]</p>	<p>Current examples of delivery robots [39] and technical reports about robot delivery forecasts [24]</p> <p>Scientific literature about robot social role, with a focus on the sociable partner paradigm [7] as a way to facilitate interaction with humans [25]</p>	<p>Current forecasts about the spread of autonomous vehicles [57; 19; 18]</p> <p>Scientific literature about different models for autonomous vehicles diffusion in cities [4]</p> <p>Current examples of cars banned in city centres, e.g. Oslo [9]</p>	<p>Current devices for wellbeing, i.e. tracking devices, sense-enhancing devices, and body-enhancing or replacing devices [54].</p> <p>Scientific literature on form transformation as a tool for carrying out tasks [16] and enabling communication and expression [11]</p>
<b>Theme</b>	<i>Responsibility</i>	<i>Delegation</i>	<i>Relationship</i>	<i>Priority</i>	<i>Adaptation</i>

**Table 1:** Five provocative design concepts of agentic things, references used to craft them, and themes.

Concept 2 introduces the theme of *delegation*, intended as a form of distribution of agency [29]. Controversies relate to the fact that the more we delegate, the more autonomy is required from the agents, and the more autonomy corresponds to less control of humans, which may result in unexpected and problematic behaviors [8; 29]. By presenting a situation in which a person, who can solely play the role of bystander [46], end up in a condition of exclusion, we suggest the need for

addressing transparency and accountability [53] as a design requirement. The third concept is used to stress the theme of *relationship* [27]. Despite the advantages of a friendly interaction, in fact, the social robots' paradigm and the highly personalized experience offered by the delivery robot rise questions of the cost-benefit of such robot social role [7], in which emotional relationship and trust become crucial [28]. The fourth concept is used to reflect on the theme of *priority*. This

refers to the frequent need introduced by automation of choosing between conflicting approaches. E.g. in the case of traffic management, priority to the needs and comfort of people may be chosen over the efficiency and improvement of a system, with consequences in efficiency named as the “price of anarchy” [56]. The fictional example presents an opposite controversial situation in which the system efficiency is preferred, causing a sacrifice condition in people who accept it in favor of a “greater good”. The fifth concept is used to reflect on *adaptation*. Although it is a natural human process of dealing with the complexity of living in the society [41], adaptation assumes, more and more, a negative connotation in relation to the perception of technological change as inevitable [44] and a consequent people tendency to play a passive role [30]. The situation presented in the scenario stresses the need for things adaptability as a design requirement [41] for addressing the complexity of human daily life and enabling agreement protocol for adjusting interactions.

### Discussion

The fictional design concepts and the story were developed with the intent of unfolding the complexity of designing things that might co-exist and co-perform with people within the context of future cities. The provocative, yet not judgmental, nature of the narration enabled to contextualize and discuss a series of classes of controversies that might result from the introduction of certain technologies. In particular, the design fiction enabled us to identify a series of practical questions that might be used to inform and guide the design of agentic things for near future cities. These, summarized in Table 2, represent an agenda for future research.

Theme	Emerging Questions
Responsibility	<p><i>What political structure do we refer to when we assign responsibility to an entity rather than another? To what extent this should be matter of concern for designers?</i></p> <p><i>Can autonomous things protect people without recognizing personal details and storing personal data?</i></p> <p><i>Can autonomous things classify people that need protection without relying on discriminatory traits?</i></p>
Delegation	<p><i>Which tasks should we delegate and why? What level of delegation can be considered appropriate? How will delegation of tasks to things influence human behaviors in the cities?</i></p> <p><i>How can things communicate their operation and decisions? How can things enable people to adjust the interaction?</i></p>
Relationship	<p><i>How to assess the appropriateness of relationships between humans and citizen things? When are social and emotional behaviors desirable?</i></p> <p><i>How can things gain human trust? What design features enable trust?</i></p>
Priority	<p><i>Can things’ judgement be accepted over the human judgement? If so, when and why?</i></p> <p><i>Can humans alter the priority of things? If so, which design features can enable that? What might be the implications?</i></p>
Adaptation	<p><i>How to decide who has to adapt to whom?</i></p> <p><i>What are the design implications of a human and things adaptation? How can adaptability be embedded in the things? And, what features would enable people to accept (or reject) a process of adaptation?</i></p>

**Table 2:** The table summarize the five themes and the emerging research questions.

## Reflections on the process

Using design fiction as an exercise to create plausible futures enabled us to discuss different visions on personal, ethical and social challenges related to agentic technologies, by envisioning concrete ways how they could affect citizens and cities. Developing this kind of predictive future scenarios and its design concepts, inspired by trend forecasts, might be complex because it requires combining two different mindsets. A speculative and imaginative attitude is necessary for envisioning things and interactions that may not exist yet, while an analytical and rational approach is asked for translating the envisioned ideas into credible concepts. Nevertheless, the process of developing this future scenario was beneficial to the project's intent of exploring the possible implications of designing things as citizens. The benefits of this process can be grouped in three facts:

- *The development of a future scenario is an iterative, dialogic and generative process.* The iterative crafting of the story represented, for the authors, an easy way to discuss their different and conflicting visions on how the future might look like and their opinions regarding the dilemmas related to the design concepts.
- *The scenario facilitates moving from abstraction to representation.* Discussing dilemmas, although already existing in literature, can be a challenging task. These, in fact, are often addressed by referring to extreme examples with the consequent feeling of estrangement and remoteness from real life situations and near future. The development of a non-catastrophic future scenario, instead, helps

to translate these abstract dilemmas into plausible design concepts.

- *The scenario enables shifting the focus from the things to a system of interactions and relationships.* Although a central role is given to the fictional design concepts, the narrative nature of the scenario helps to move the focus from the details of the things to the implications of these in the interaction with people. The need for providing a credible narration, in fact, requires the authors to think about the setting, the characters, the problem(s), the goal and maybe even a plot. As a result, the scenario helps to understand the relational nature of the things.

Ultimately, as designers we are asked to envision the things that will determine our future society, an act that today is maybe more complex than ever. The diffusion of AI-based applications and the novel performative capabilities of things may introduce unprecedented models of interaction as well as risks. In this regard, scenarios allow to explore the "what if" and possible alternative futures. Through design fiction we can use imagination and narration oriented to specific purposes; it should be used to explore and inspire, but also to reveal the potential implications of design.

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## References

1. Peter M. Asaro. 2007. Robots and responsibility from a legal perspective. *Proceedings of the IEEE*, pp. 20-24.

2. James Henry Auger. 2014. Living with robots: A speculative design approach. *J of Human-Robot Interaction* 3, 1: 20-42. DOI: <https://doi.org/10.5898/jhri.3.1.auger>
3. James Henry Auger. 2013. Design fictions an introduction and provisional taxonomy. *Digital Creativity* 24, 1: 11-35. DOI: <https://doi.org/10.1080/14626268.2013.769453>
4. Kay W. Axhausen. 2017. How to organise a 100% autonomous transport system? In *Transport Seminar at Newcastle University, Civil Engineering and Geosciences*. IVT, ETH Zurich. DOI: <https://doi.org/10.3929/ethz-b-000130873>
5. Julian Bleecker. A manifesto for networked objects: Cohabiting with pigeons, aphids and abios in the Internet of Things. 2006. Retrieved May 1, 2018 from <http://nearfuturelaboratory.com/files/WhyThingsMatter.pdf>
6. Mark Blythe. 2014. Research through design fiction: narrative in real and imaginary abstracts. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '14)*. ACM, New York, NY, USA, 703-712. DOI: <https://doi.org/10.1145/2556288.2557098>
7. Cynthia Breazeal. 2004. Social interactions in HRI: the robot view. *IEEE Transactions on Systems, Man, and Cybernetics, Part C* 34, 2, 181-186. DOI= <http://dx.doi.org/10.1109/TSMCC.2004.826268>
8. Cristiano Castelfranchi and Rino Falcone. 1998. Towards a theory of delegation for agent-based systems. *Robotics and Autonomous Systems*, 24(3-4), 141-157. DOI: [https://doi.org/10.1016/S0921-8890\(98\)00028-1](https://doi.org/10.1016/S0921-8890(98)00028-1)
9. Athlyn Cathcart-Keays. 2017. Oslo's car ban sounded simple enough. Then the backlash began. *The Guardian*. Retrieved April 28, 2018 from: <https://www.theguardian.com/cities/2017/jun/13/oslo-ban-cars-backlash-parking>. [Accessed 29 April 2018].
10. Nazli Cila, Iskander Smit, Elisa Giaccardi, and Ben Kröse. 2017. Products as Agents: Metaphors for Designing the Products of the IoT Age. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17)*. ACM, New York, NY, USA, 448-459. DOI: <https://doi.org/10.1145/3025453.3025797>
11. Marcelo Coelho and Jamie Zigelbaum. 2011. Shape-changing interfaces. *Personal Ubiquitous Comput.* 15, 2 (February 2011), 161-173. DOI= <http://dx.doi.org/10.1007/s00779-010-0311-y>
12. Martijn de Waal. 2017. A city is not a galaxy: Understanding the city through urban data. In *Data and the city*, Rob Kitchin, Tracey Lauriault and Gavin McArdle (eds.), Taylor & Francis, 37-50.
13. Carl DiSalvo and Jonathan Lukens. 2011. Non-anthropocentrism and the non-human in design: Possibilities for designing new forms of engagement with and through technology. In *From social butterfly to engaged citizen: urban informatics, social media, ubiquitous computing, and mobile technology to support citizen engagement*, In Marcus Foth, Laura Forlano, Christine Satchell and Martin Gibbs (eds.), MIT Press, 421-437.
14. Anthony Dunne and Fiona Raby. 2013. *Speculative everything: design, fiction, and social dreaming*. MIT press.
15. Anthony Dunne and Fiona Raby. 2007. *Technological Dreams Series: No.1, Robots*. Retrieved May 1, 2018 from <http://www.dunneandraby.co.uk/content/projects/10/0>
16. Sean Follmer, Daniel Leithinger, Alex Olwal, Akimitsu Hogge, and Hiroshi Ishii. 2013. inFORM: dynamic physical affordances and constraints through shape and object actuation. In *Proceedings of the 26th annual ACM symposium on User*

- interface software and technology (UIST '13). ACM, New York, NY, USA, 417-426. DOI: <https://doi.org/10.1145/2501988.2502032>
17. Elisa Giaccardi, Chris Speed, Nazli Cila and Melissa L. Caldwell. 2016. Things as co-ethnographers: Implications of a thing perspective for design and anthropology. In *Design Anthropological Futures*, Rachel C. Smith, Kasper T. Vaskilde, Mette G. Kjaersgaard, Ton Otto, Joachim Halse, Thomas Binder (eds.). Bloomsbury Academic, 235-248.
  18. Kate Gibson. 2018. *Forecast: Autonomous-Vehicle Sales to Top 33 Million in 2040. The Drive*. Retrieved April 29, 2018 from: <http://www.thedrive.com/sheetmetal/17298/forecast-autonomous-vehicle-sales-to-top-33-million-in-2040>
  19. Paul Goddin. 2015. *Uber's plan for self-driving cars bigger than its taxi disruption. Mobility Lab*. Retrieved April 29, 2018 from: <https://mobilitylab.org/2015/08/18/ubers-plan-for-self-driving-cars-bigger-than-its-taxi-disruption/>
  20. Rodrigo F. Gonzatto, Frederick van Amstel, Luiz E. Merkle, and Timo Hartmann. 2013. The ideology of the future in design fictions. *Digital Creativity* 24, 1: 36-45. DOI: <https://doi.org/10.1080/14626268.2013.772524>
  21. Derek Hales. 2013. Design fictions an introduction and provisional taxonomy. *Digital Creativity* 24, 1: 1-10, DOI: <https://doi.org/10.1080/14626268.2013.769453>
  22. Julian R. Hanna and Simone R. Ashby. 2016. From Design Fiction to Future Models of Community Building and Civic Engagement. In Proceedings of the 9th Nordic Conference on Human-Computer Interaction (NordiCHI '16). ACM, New York, NY, USA. DOI: <https://doi.org/10.1145/2971485.2993922>
  23. Tom Jenkins, Christopher A. Le Dantec, Carl DiSalvo, Thomas Lodato, and Mariam Asad. 2016. Object-Oriented Publics. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*. ACM, New York, NY, USA, 827-839. DOI: <https://doi.org/10.1145/2858036.2858565>
  24. Martin Joerss, Jurgen Schröder, Florian Neuhaus, Christoph Klink and Florian Mann. 2016. Parcel delivery. The future of last mile. *Technical report on Travel, Transport and Logistics*, McKinsey&Company.
  25. Keith S. Jones and Elizabeth A. Schmidlin. 2011. Human-robot interaction: toward usable personal service robots. *Reviews of Human Factors and Ergonomics*, 7(1), 100-148. DOI: <https://doi.org/10.1177/1557234X11410388>
  26. Kyunghoon Kim, Soonil Bae and Kwanghak Huh, "Intelligent surveillance and security robot systems," *2010 IEEE Workshop on Advanced Robotics and its Social Impacts*, Seoul, 2010, pp. 70-73. DOI: <https://doi.org/10.1109/arso.2010.5679624>
  27. Ben Kirman, Conor Linehan, Shaun Lawson, and Dan O'Hara. 2013. CHI and the future robot enslavement of humankind: a retrospective. In *CHI '13 Extended Abstracts on Human Factors in Computing Systems* (CHI EA '13). ACM, New York, NY, USA, 2199-2208. DOI: <https://doi.org/10.1145/2468356.2468740>
  28. Tora Koyama. 2016. Ethical issues for social robots and the trust-based approach. In *Advanced Robotics and its Social Impacts (ARSO), 2016 IEEE Workshop on* (pp. 1-5). IEEE. DOI: <https://doi.org/10.1109/arso.2016.7736246>
  29. Lenneke Kuijter and Elisa Giaccardi. 2018. Co-performance: Conceptualizing the Role of Artificial Agency in the Design of Everyday Life. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (CHI '18).

- ACM, New York, NY, USA. DOI:  
<https://doi.org/10.1145/3173574.3173699>
30. Joseph Lindley and Paul Coulton. 2016. Pushing the Limits of Design Fiction: The Case For Fictional Research Papers. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (CHI '16). ACM, New York, NY, USA, 4032-4043. DOI: <https://doi.org/10.1145/2858036.2858446>
  31. Donald MacKenzie and Judy Wajcman. 1986. Introductory Essay: The Social Shaping of Technology. *idem* (eds), 2-25.
  32. Marco Margaritoff. 2017. Drones in Law Enforcement: How, Where and When They're Used. *The Drive*. Retrieved April 28, 2018 from: <http://www.thedrive.com/aerial/15092/drones-in-law-enforcement-how-where-and-when-theyre-used>
  33. Victor Margolin. 2007. Design, the future and the human spirit. *Design Issues*, 23(3), 4-15. DOI: [10.1162/desi.2007.23.3.4](https://doi.org/10.1162/desi.2007.23.3.4)
  34. Thomas Markussen and Eva Knutz. 2013. The poetics of design fiction. In *Proceedings of the 6th International Conference on Designing Pleasurable Products and Interfaces* (DPPI '13). ACM, New York, NY, USA, 231-240. DOI=<http://dx.doi.org/10.1145/2513506.2513531>
  35. Rachel Metz. 2014. Rise of the robot security guards. MIT Technology Review. Retrieved April 28, 2018 from: <https://www.technologyreview.com/s/532431/rise-of-the-robot-security-guards/>
  36. Jinhan Mo, Yinping Zhang, Qiujian Xu, Jennifer Joaquin Lamson and Rongyi Zhao. 2009. Photocatalytic purification of volatile organic compounds in indoor air: a literature review. *Atmospheric Environment*, 43(14), 2229-2246. DOI: <https://doi.org/10.1016/j.atmosenv.2009.01.034>
  37. Michael Nagenborg, Rafael Capurro, Jutta Weber, and Christoph Pingel. 2008. Ethical regulations on robotics in Europe. *AI Soc.* 22, 3 (January 2008), 349-366. DOI= <http://dx.doi.org/10.1007/s00146-007-0153-y>
  38. Bjorn Nansen, Luke van Ryn, Frank Vetere, Toni Robertson, Margot Brereton, and Paul Dourish. 2014. An internet of social things. In *Proceedings of the 26th Australian Computer-Human Interaction Conference on Designing Futures: the Future of Design*. ACM, New York, NY, USA, 87-96. DOI=<http://dx.doi.org/10.1145/2686612.2686624>
  39. Guido Noto La Diega. 2016. Machine Rules. Of Drones, Robots, and the Info-Capitalist Society. *The Italian Law Journal*, Vol. 02, No. 02, pp. 367-403.
  40. Parmy Olson. 2018. Amazon just sparked a race to bring robots to our doors. *Forbes*. Retrieved April 29, 2018 from: <https://www.forbes.com/sites/parmyolson/2018/01/31/amazon-just-sparked-a-race-to-bring-robots-to-our-doors/#772265f32b3a>
  41. Xavier M. Orriols and Laura S. Gómez. 2017. How innovation in a robot shows the commitment of a whole company. *Ferrovial Blog*. Retrieved April 28, 2018 from: <https://blog.ferrovial.com/en/2017/06/robot-innovation-commitment/>
  42. Leslie Phillips. 2013. *Human adaptation and its failures*. Academic Press.
  43. Ana Puig-Pey, Yolanda Bolea, Antoni Grau and Josep Casanovas. 2017. Public entities driven robotic innovation in urban areas. *Robotics and Autonomous Systems*, 92, 162-172. DOI: <https://doi.org/10.1016/j.robot.2017.03.006>
  44. Matteo Reggente, Alessio Mondini, Gabriele Ferri, Barbara Mazzolai, Matteo Gabelletti, Paolo Dario and Achim J. Lilienthal. 2010. The dustbot system:

- Using mobile robots to monitor pollution in pedestrian area. *Proc. of NOSE*.
45. Selma Šabanović. 2010. Robots in society, society in robots. *International Journal of Social Robotics*, 2(4), 439-450. DOI: <https://doi.org/10.1007/s12369-010-0066-7>
  46. Erol Şahin. 2004. Swarm robotics: From sources of inspiration to domains of application. In *International workshop on swarm robotics* (pp. 10-20). Springer, Berlin, Heidelberg. DOI: [https://doi.org/10.1007/978-3-540-30552-1\\_2](https://doi.org/10.1007/978-3-540-30552-1_2)
  47. Jean Scholtz. 2003. Theory and Evaluation of Human Robot Interactions. In Proceedings of the 36th Annual Hawaii International Conference on System Sciences (HICSS'03) - Track 5 - Volume 5 (HICSS '03), Vol. 5. IEEE Computer Society, Washington, DC, USA, 125.1-.
  48. Nancy Smith, Shaowen Bardzell, and Jeffrey Bardzell. 2017. Designing for Cohabitation: Naturecultures, Hybrids, and Decentering the Human in Design. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*. ACM, New York, NY, USA, 1714-1725. DOI: <https://doi.org/10.1145/3025453.3025948>
  49. Bruce Sterling. 2009. COVER STORY: Design fiction. *interactions* 16, 3 (May 2009), 20-24. DOI: <https://doi.org/10.1145/1516016.1516021>
  50. Guglielmo Tamburrini. 2009. Robot ethics: A view from the philosophy of science. *Ethics and robotics*, pp. 11-22.
  51. Joshua Tanenbaum. 2014. Design fictional interactions: why HCI should care about stories. *interactions* 21, 5 (September 2014), 22-23. DOI: <https://doi.org/10.1145/2648414>
  52. Alex Taylor. 2017. What lines, rats, and sheep can tell us. *Design Issues* 33, 3: 25-36.
  53. Philip van Allen, Joshua McVeigh-Schultz, Brooklyn Brown, Hye Mi Kim, and Daniel Lara. 2013. AniThings: animism and heterogeneous multiplicity. In *CHI '13 Extended Abstracts on Human Factors in Computing Systems (CHI EA '13)*. ACM, New York, NY, USA, 2247-2256. DOI: <https://doi.org/10.1145/2468356.2468746>
  54. Sandra Wachter, Brent Mittelstadt and Luciano Floridi. 2017. Transparent, explainable, and accountable AI for robotics. *Science Robotics*, Vol. 2, Issue 6. DOI: <https://doi.org/10.1126/scirobotics.aan6080>
  55. David Wortley, Ji-Yuong An, and Claudio R. Nigg. 2017. Wearable technologies, health and well-being: A case review. *Digital Medicine*, 3(1), 11. DOI: [https://doi.org/10.4103/digm.digm\\_13\\_17](https://doi.org/10.4103/digm.digm_13_17)
  56. Hyejin Youn, Michael T. Gastner and Hawoong Jeong. 2008. Price of anarchy in transportation networks: efficiency and optimality control. *Physical review letters*, 101(12), 128701. DOI: <https://doi.org/10.1103/physrevlett.101.128701>
  57. Jess M. Yu, Miyoung Kim and Muralikumar Anantharaman. 2017. Chipmaker Nvidia's CEO sees fully autonomous cars within 4 years. *Reuters*. Retrieved April 29, 2018 from: <https://www.reuters.com/article/us-nvidia-ai-chips/chipmaker-nvidias-ceo-sees-fully-autonomous-cars-within-4-years-idUSKBN1CV192?feedType=RSS&feedName=technologyNews>