2020

Designing Tech Policy: Instructional Case Studies for Technologists and Policymakers

David G. Hendry

UNIVERSITY OF WASHINGTON TECH POLICY LAB

Designing Tech Policy:

INSTRUCTIONAL CASE STUDIES for TECHNOLOGISTS and POLICYMAKERS

DAVID G. HENDRY

TECH POLICY LAB

The Tech Policy Lab at the University of Washington

The Tech Policy Lab is a unique, interdisciplinary collaboration at the University of Washington that aims to enhance technology policy through research, education, and thought leadership. Founded in 2013 by faculty from the University's Allen School of Computer Science & Engineering, Information School, and School of Law, the Lab aims to bridge the gap between technologists and policymakers and to help generate wiser, more inclusive tech policy.

Designing Tech Policy: Instructional Case Studies for Technologists and Policymakers

David G. Hendry

Value Sensitive Design Lab
Information School
University of Washington
dhendry@uw.edu

UW Tech Policy Lab

William H. Gates Hall, Room 222
University of Washington
UW Campus Box 353020
Seattle, WA 98195-3020

info@techpolicylab.org

www.techpolicylab.org

Acknowledgements

I thank my colleagues – including Megan Finn, Batya Friedman, Joseph Janes, Amy Ko, and David Stearns – who have creatively employed these case studies in their teaching and offered feedback. I thank Stephanie Ballard, Mike Katell, and Nick Logler for superb assistance in preparing these case studies. Finally, in my own teaching, my sincere thanks to the hundreds of students who have engaged these case studies and who have inspired me with their critical and imaginative work.

Creative Commons License

AUGUST 2020 UNIVERSITY OF WASHINGTON

TABLE OF CONTENTS

INTRODUCTION

The UW Tech Policy Instructional Case Studies position students to consider the deeply interactional processes of human values and technology. Within pedagogical bounds, students engage both technical and policy elements and develop design solutions. For instructors, the case studies have been written and formatted so that they can be appropriated for varied educational settings.

Each of the tech policy instructional case studies (see Table 1) follow this three-part pattern:

1. **Background.** The case studies begin with information on the technology and social context at hand. This introduces both the students and the instructor to the technical problem and the social considerations that will be addressed in the design activity.

2. **Design activity.** The case studies include a suggested design process, beginning with a design prompt. The design prompt invites students to consider an open-ended challenge in which they must find and frame their own problems within a specific tech policy theme. After the prompt, each case study presents students with a step-by-step design process using methods from value sensitive design (Friedman, Hendry, & Borning, 2017; Friedman & Hendry, 2019). The process can be engaged to varying degrees of depth and robustness.

3. **Reflections.** Each case study includes reflective questions about the solution and about the design process. The reflective questions can be used, for example, to structure classroom discussion or in writing assignments completed outside of class.

Instructional Case Study	Tech Policy Theme
"Drones Okay" Playground: Fun with Personal Drones. Considers the design of a multi-use playground suitable for safely flying personal drones for fun and recreation.	Autonomous vehicles
Workforce Management: Scheduling Call-Center Workers. Considers the design of regulations for algorithms that predict staffing needs and schedule employees.	Artificial Intelligence and work
NeighborSpin: Sharing Laundry Facilities. Considers the design of a peer-to-peer platform for sharing laundry facilities.	The sharing economy
Gaslighting and the Smart Home. Considers protecting an individual from being abused through psychologically damaging adjustments to a home living environment.	Internet of Things

Table 1. The tech policy instructional case studies.

This document includes background information on the case studies and the four case studies. Chapter one describes the pedagogical assumptions that underlie the case studies. Each of the case studies uses methods developed in value sensitive design. Chapter two gives a closer look at those methods. Chapters three through six contain the individual case studies, including background information on the technology and social context at hand, the recommended design process, and prompts for reflective discussion and writing. Finally, the document includes a glossary, which gives brief definitions of selected terms.

1

INSTRUCTIONAL CASE STUDIES
Background

In technical education, students might pursue design and engineering projects in a largely value-neutral manner. However, technical projects, along with the tools and technologies they produce, are not value-neutral. To the contrary, tools and technologies make some goals easier to obtain and others harder, support some human experiences and values but not others, lead to unanticipated value tensions, and so forth. Thus, in general, tools and technologies unavoidably shape human experience. At the same time, when a technology is introduced into society, people and institutions adapt, leading to new practices, norms, and policies. These processes, in turn, lead to new technologies, and so forth, on and on.

"Technology is neither good nor bad; nor is it neutral"

(Kranzberg, 1986).

TECH POLICY: TOOLS, TECHNOLOGY, AND POLICY

The case studies work with broad definitions of policy, tool, and technology. From the Oxford English Dictionary:

> **Policy** (*noun*). A principle or course of action adopted or proposed as desirable, advantageous, or expedient; esp. one formally advocated by a government, political party, etc. ("Policy," n.d., para. 4)

The case studies, consistent with this definition, take a broad view of policy, which is often linked to a particular setting or context, characterized by natural, social, or technical dimensions. The following are different forms of policy, ranging from the formal and institutional, to the informal and personal:

> international laws • local laws • government or industrial regulations • tax systems • medical informed consent • licensing agreements • incentive systems • terms of use • codes of conduct • standards • guidelines and style guides • wilderness travel protocols • sexual consent • family rules • rules among friends (norms) • ...

Similarly, the case studies use a broad definition of technology. From the Oxford English Dictionary:

> **Technology** (*noun*). **a**. The branch of knowledge dealing with the mechanical arts and applied sciences ... ; **b.** The application of such knowledge for practical purposes ... **c.** The product of such application ... ("Technology," n.d., para. 4)

With this definition, we see that technology is knowledge, which when applied leads to a product, often a tool, artifact, or device, which a person might hold in her hand. Technology also includes the hardware and software that surround the places where human beings are born, dwell, go to school, work, recreate, worship, retire, die, and so forth. The built environment shapes human experience and action. Indeed, the relationship between human beings and technology is deeply interactional, one shaping the other and vice versa:

> "We encounter the deep questions of design when we recognize that in designing tools we are designing ways of being." (Winograd and Flores, 1986, p. xi)

Technology can be expansive infrastructure, which under normal circumstances we take for granted and is often difficult to change, such as the power grid or software foundations needed for the Internet. Often tools work together with infrastructure. Electric cars, for example, to be charged, generally need the power grid. But, millions of electric cars, all seeking power in an uncoordinated manner, might lead to instabilities in the existing infrastructure.

The distinction between "tools" and "technology" is nuanced. Accordingly, we'll use the phrase *tools and technology* to refer to the *products* that result from the application of scientific knowledge. Depending on the context, we will use one word or the other, clarifying the intended meaning when precision is required.

In addition, we will consider policy, also a product of knowledge, to be a special kind of tool, as policies afford or constrain human action in ways that are similar to the effects of a tool or technology. With all tools, technologies, and policies we can ask these kinds of questions:

- Will a human action be constrained or made impossible?
- Will a new human action become possible?
- Will a human action be supported or perhaps amplified?
- How, or in what circumstances, might a tool become harmful, and, in the extreme even become a weapon. What policies might govern inappropriate use or address harms that might reasonably be expected to occur?

Finally, the phrase "tech policy" shows that technologies and policies are often in relation to each other. But, the relationship can be varied and nuanced, as seen in these broad examples:

- **Reactive policy-making.** After a technology is developed, or likely to be imminently developed, a policy might be designed to *reactively* prohibit its use for particular purposes. *Examples*: Prohibitions against fully autonomous weapon systems, limits on how facial recognition technologies can be deployed.
- **Proactive policy-making.** A policy might be developed *proactively* to fuel innovation of a technology for particular purposes. *Examples*: Higher gas mileage targets for vehicle fleets, certification of autonomous drone-flying in remote rural areas.

- **Innovative policy-workarounds.** Technology might be designed to creatively work around an approved standard of limits and requirements. *Examples*: Designing high-performance bicycles such that they conform to Olympic regulations, designing investment strategies that avoid taxation, developing design processes that strictly satisfy regulations while leading to more rapid product development.
- **Policy-making for technical innovation.** Prior to the development of a technology, or contemporaneously, entrepreneurs might lobby for the development of policy favorable to their project. *Example*: Changing the laws related to pet sitting to pave the way for a new sharing-economy businesses.
- **Policy-making as political response.** The invention of a new technology might lead to public or corporate demands for a new policy to govern its use. *Examples*: Use of AI in making hiring decisions, governance of Internet of Things in domestic settings.

The key point is that engineering processes can be strengthened by considering both technical requirements and policy requirements within design processes.

LEARNING OBJECTIVES

Given this introduction to policy, tools, and technology, the overarching learning aim for the case studies is:

> To develop student's knowledge and skills for how technology and policy go hand-in-hand, with each shaping the other.

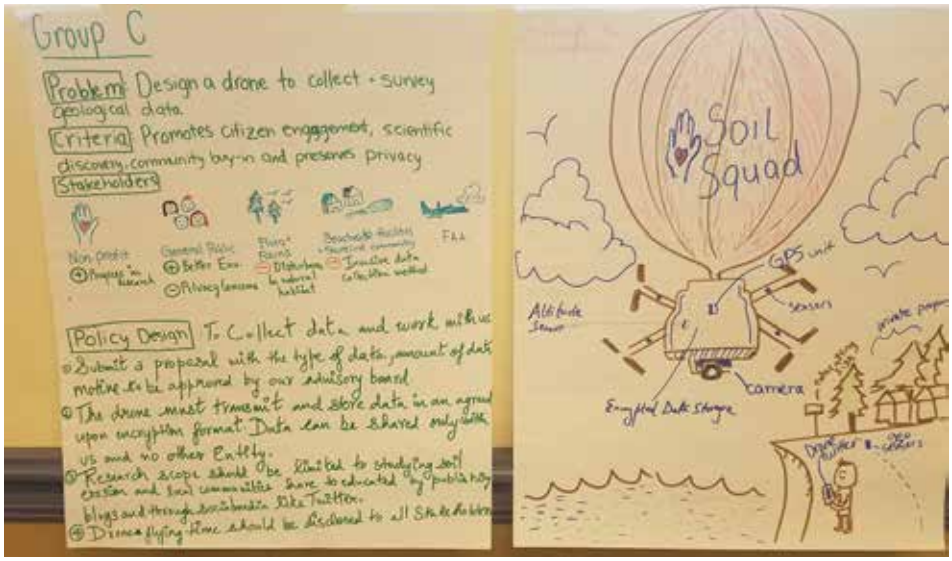
This learning aim is met by positioning students to design solutions to carefully crafted design prompts. The prompts are framed so that students engage both policy and technical elements within a particular theme.

In each case study, students are guided through a design process drawing on four common methods from value sensitive design (Friedman, Hendry, & Borning, 2017; Friedman & Hendry, 2019). After developing experience with a case study, students should be able to adapt and incorporate these methods into their own projects.

The case studies are "modular" and are intended to be incorporated into technical classes, that is, classes where students are learning to design and implement solutions to information or engineering problems. Students learn to ask and engage such questions as:

- What is the *sociotechnical context* in which a target technology will be used?
- Who are the *direct* and *indirect stakeholders* of the target technology?
- What *values* might stakeholders hold and what values might be implicated by the target technology?
- What *value tensions* emerge and how might they be addressed?
- What *policy elements* exist, or might be invented, in a sociotechnical context?
- How might those policy elements *afford* or *constrain* technical features and development?
- How might the policy elements and technological features work together to meet engineering and/or policy requirements?

To engage the above questions and to develop familiarity of these concepts, students learn to employ specific methods from value sensitive design.



STUDENT WORK. An example in-class deliverable showing a solution to the design of a drone for surveying geological systems through citizen science projects. Design prompt and process adapted from Case Study 1: *"Does Okay" Playground: Fun with Personal Drones*. (Instructor credit: Prof. Megan Finn, The Information School, University of Washington, 2017).

CASE STUDY FORMAT AND INSTRUCTOR NOTES

Going beyond analysis and critique, the case studies are *design-oriented*, that is, students are positioned to design solutions to problems and to critically reflect on the sociotechnical context. Each of the case studies comprise the following:

1. **Background material,** which introduces the sociotechnical context and some key tech policy questions.
2. **Suggested design process,** which introduces the design situation and presents students with a broad and then presents a series of steps that scaffold students' engagement with the design situation.
3. **Reflective prompts and exercises,** which prompt students to critically reflect on process and outcomes of the case study.

In addition, each case study includes instructor notes and a bibliography.

BASE FORMAT. The case studies are presented with the assumption that they will be delivered as a 110-minute class activity. That said, the case studies are intended to be revised for different pedagogical settings and goals. They have been used in these settings, among others:

- A single activity in a 50-minute class (150 first and second year undergraduate students in Informatics)
- A single 3-hour studio project (newly admitted graduate students in a professional masters degree)
- A 5-hour project, begun in class and completed outside of class (150 first and second year undergraduate students in Informatics)
- A 10-15 hour project, completed over two 3-hour studio sessions and outside-class work (fourth year undergraduate students in Informatics).

PEDAGOGICAL COMMITMENTS. The case studies make the following broad pedagogical commitments:

- **Action, then reflection.** Following Donald Schön's theory of professional practice, the case studies prompt students to design and to then reflect on their process and products (Schön, 1990). To address the intentional ambiguity of the problem brief, students find and frame their own specific problem, often prior to fully understanding the issues that underlie the problem brief. Students' understanding of the problem develops by solving it. Then, in the process of engaging the problem, and at the end, students are prompted to critically reflect on their work.
- **Work concretely.** Students develop a concrete solution, with both technical and policy requirements. The solution is typically represented through a written scenario along with sketches and idea maps.
- **Exposure to method, not depth.** The case studies introduce methods and ways of thinking about tech policy, largely through stakeholders and values. The emphasis is on exposing students to multiple methods linked together in a simplified design process rather than focusing in-depth on a single method.
- **Progress, not perfection.** Students work with incomplete information and within a simplified process. Seeking to avoid the paralyzing effects of "perfection," and following value sensitive design, the case studies prompt students to make meaningful progress.

INSTRUCTOR NEEDS. For instructors, the case studies are intended to be responsive to a variety of educational settings and formats, as follows:

- **Adaptability.** The format for the case studies is flexible and general. Instructors might focus on particular topics or extend the case studies in new directions. Instructors, in addition, might use or appropriate the format to represent new or emerging topics in tech policy.
- **Depth.** The case studies rest on research base that might motivate and catalyze a sustained research and design project. The case studies offer theoretical constructs and provide a body of examples.
- **Simplicity.** The case studies are reviewable in about 30 minutes and are structured so that they can be readily revised.
- **Topical appeal.** The case studies are crafted to be of interest to a broad spectrum of learners. While the topics are of immediate public interest, the underlying issues are likely to be with us for many years to come.

REFERENCES

Friedman, B., Hendry, D. G., & Borning, A. (2017). A survey of value sensitive design methods. *Foundations and Trends in Human-Computer Interaction*, *11*(23), 63–125. http://doi.org/10.1561/1100000015

Friedman, B., & Hendry, D. G. (2019). *Value Sensitive Design: Shaping Technology with Moral Imagination*. Cambridge, MA: MIT Press.

Kranzberg, M. (1986). Kranzberg's laws. *Technology and Culture*, *27*, 544-560.

Policy. (n.d.). In *Oxford English Dictionary*. Retrieved from http://www.oed.com

Schön, D. A. (1990). *Educating the Reflective Practitioner: Toward a New Design for Teaching and Learning in the Professions*. San Francisco, CA: Jossey-Bass Publishers.

Technology. (n.d.). In *Oxford English Dictionary*. Retrieved from http://www.oed.com

Winograd, T., & Flores, F. (1986). *Understanding Computers and Cognition: A New Foundation for Design*. Boston, MA: Addison-Wesley.

2 Methods

For tech policy analysis and design in pedagogical settings, we have found it useful to employ methods from value sensitive design. Friedman and Hendry (2019) give a comprehensive review of seventeen methods in value sensitive design, methods that have been used in diverse research, information system design, and engineering projects.

We do not reproduce that review, nor do we present a comprehensive tutorial. Instead, we present simplified introductions to the methods used in the case studies. These methods include:

- Direct and indirect stakeholder analysis
- Value source analysis
- Co-evolution of technology and social structure
- Value scenarios.

"Methods help designers focus their attention on critical elements of the design situation, positioning them to obtain design insights"

(Friedman & Hendry, 2020, p. 59).

DIRECT AND INDIRECT STAKEHOLDER ANALYSIS

Stakeholders are individuals, organizations, institutions, and societies. Stakeholders can also be non-human living things with moral or ethical standing such as salmon, killer whales, rivers, and ecosystems. In some projects, historic buildings or sacred mountain tops might also be considered stakeholders.

When a stakeholder interacts directly with a tool or technology they are referred to as a *direct stakeholder*. Direct stakeholders are commonly called "users." In user-centered design, the aim is largely to improve the interaction between user and system, often as defined by usability assessments.

Indirect stakeholders, on the other hand, are not users—they do not use the technology under consideration—but are nevertheless impacted by it. Consideration of the interests of indirect stakeholders often lead to requirements that would otherwise not be identified.

For example, consider a patient's electronic health record. Suppose a system is designed whereby medical personnel and insurance companies have access to health records but patients do not. In this case, the doctor and insurance company would be direct stakeholders and the patient would be an indirect stakeholder.

Putting aside the important question of whether it is reasonable to not give patients direct access to their health records, note that the patient has a tremendous stake in the system. Errors in the record might lead to diagnostic or treatment errors. Or, a data breach might lead to a patient's privacy being compromised. In these cases, the possibility of physical or psychological harm is likely. Thus, indirect stakeholders can be as important to the success of a system as direct stakeholders.

In-class student activity: Conduct a brief direct and indirect stakeholder analysis of an Electronic Health Records system.

Key questions: Who uses the system (direct stakeholders) and who is impacted by it (indirect stakeholders).

Direct stakeholders

- Doctors (add/read notes)
- Nurses (add/read notes)
- Medical personnel
- Insurance companies (bill patients or family)
- Research projects (analyze medical records for trends)
- Government regulators (check for HIPPA compliance)

Indirect stakeholders

- Patient (no access to medical records)
- Family members (impacted by patient's health)

Variation in roles: If a doctor became a patient, her role would shift from direct stakeholder to indirect stakeholder.

Variation in technology: If the Electronic Health Records system were designed to be accessible by patients then they would become direct stakeholders but family members would remain indirect stakeholders.

Complications to consider: What about adolescents who are patients? What about adult patients who are blind? What about family members who need to access the record in an emergency.

Method panel 1. The outcome of a simplified direct and indirect stakeholder analysis of an Electronic Health Records system. (Suggested activity: Explore the activities and tasks that some of the stakeholders might need to complete with an Electronic Health Records system. What are the key communication and information flows among stakeholders?)

One common indirect stakeholder is the "bystander," who unexpectedly encounters a technology and is impacted by it. Some examples:

- A street photographer inadvertently takes a photograph of a bus commuter (*technology*: camera; *direct stakeholder*: street photographer; *indirect stakeholder*: bus commuter, as bystander)
- A group of killer whales is adversely impacted by boat noise (*technology*: boat; *direct stakeholder*: boat captain; *indirect stakeholders*: the whales, as bystanders)
- A local teenager explains to a tourist how to connect to a community free wireless network (*technology*: wireless network; *direct stakeholder*: tourist; *indirect stakeholder*: teenager, as bystander).

A second common, indirect stakeholder is the "data subject," a stakeholder for whom data is collected. Examples:

- As individual shoppers search and buy things, the resulting timestamped data traces (e.g., characters typed, mouse movements, links clicked, pages viewed, ads seen, etc.) are saved in data systems (*technology*: data analytics; *direct stakeholder*: business; *indirect stakeholder*: shopper, as data subject)
- Automatic license plate readers capture the location, time, and speed of a car as it moves through a city (*technology*: public cameras; *direct stakeholders*: police; *indirect stakeholders*: drivers, as data subjects).

Among the first steps of a tech policy project is to identify the direct and indirect stakeholders. Initially, for an in-class activity, this can be done by creatively exploring a problem situation in a short brainstorming session. For a substantial project, students might conduct a review of the scholarly literature, the popular press, or online message boards. Or, they might conduct an empirical study, perhaps semi-structured interviews with stakeholders or perhaps other field work that draws on empirical methods from social science or engineering. While the case studies do you include robust studies in the field, they might be adapted to do so.

In the early phases of a stakeholder analysis, it is common to develop a long list of direct and indirect stakeholders. Accordingly, for the case studies, students are prompted to prioritize and select a small number of stakeholders and to explicate principled reasons for their choices.

VALUE SOURCE ANALYSIS

Human values shape and provide justification for tech policy choices. In value sensitive design, a *value* is defined as: *what is important to people in their lives, with a focus on ethics and morality* (Friedman & Hendry, 2019, p. 24). Examples of values include human dignity, justice, environmental sustainability, privacy, access, security, public good, safety, usability, calmness, fun, solitude, among many more. Many values may come under consideration in a project, and the relationships among values can be intricate. The set of values is often represented as a web or network, inviting discussion and clarification of the relationships among values. Commonly, when one value is addressed, other values become implicated. Security, privacy, and trust, for example, are often in an intricate balance.

When working with values, a key objective is to be clear and transparent. Conducting a value source analysis is one method for doing so.

A first step is to consider the values of the design situation and who among the stakeholders holds a value or set of values. For relatively short design activities, like the direct and indirect stakeholder analysis (see Method panel 1), students rely on their intuitions for the design situation and stakeholders.

A next step is to propose working definitions for the values under consideration. Working definitions orient designers toward the design situation and stakeholder interests, harms, and benefits.

Then, it is common is to clarify the origins of the identified values; that is, addressing the question of who proposed that a value be considered in the design process. Three common sources of values are:

- **Explicitly supported project values.** These are the values that are used to guide design processes. Explicitly supported project values can serve as design constraints at the beginning of a project or evaluation criteria for the finished system.
- **Designer values.** These refer to the personal or professional values that a designer brings to a research or design project. Environmental sustainability, for example, might be a designer value, but not an explicitly supported project value.
- **Stakeholder values.** These refer to the values held by different stakeholder groups. Frequently, stakeholder values are elicited through empirical investigations or identified in existing technology or policy.

It is very common to identify a long list of values. Like the list of direct and indirect stakeholders, students will need to prioritize the values and consider just a small number.

It is also common to encounter tensions among the identified values. For example: (1) Two different stakeholder groups might hold different values; or (2) A designer's values might be quite different than the explicitly supported project values.

It can be difficult to resolve value tensions. For clarity and transparency, the case studies prompt students to surface value tensions and to propose how they might be resolved.

In-class student activity: Conduct a brief value source analysis for a team working on an Electronic Health Records system.

Questions: What are the key values? Where do the values originate (the sources)?

VALUES / Informal working definition

Paternalism An action intended to enhance the well-being of a patient, given with no or limited patient involvement.

Well-being The psychological and physical health of a patient.

Autonomy The patient is free of control; the patient can do as he or she pleases.

Info. access Medical records can be easily read on browsers and smart phones.

Security Only authorized direct stakeholders can gain access to medical records.

STAKEHOLDER VALUES

Doctors might be *paternalistic* because of their training and because they do not believe that, in general, patients can understand their medical records; hence, doctors make decisions for patients. Patients have no need to consult their records.

Patients might believe in their *autonomy*, that they have the ability to accurately interpret their medical records and make good decisions. Further, patients believe it is their right to be able to view their records, if only to identify errors in the reporting.

DESIGNER VALUES

Designers on the project team might generally hold the personal value of *libertarianism*, that is, that people should have full control of their lives and to act freely so long as their actions do not harm others. **Engineers** on the team hold the professional value that information systems should be secure.

EXPLICITLY SUPPORTED PROJECT VALUES

The design project has been funded by **insurance companies** who wish to generally support doctors' interests. Thus, in general, and controversially, the team has decided to prioritize doctors *paternalism*, along with *well-being* and *security.*

VALUE TENSIONS

1. The tension between *paternalism* (doctor) and *autonomy* (patient). Given the tension, how might info. access be obtained?
2. The tension between the designers' personal value of *libertarianism* and the explicitly supported value to support the values of doctors, namely *paternalism*.

Method panel 2. Brief example of a value source analysis. *(Suggested activity:* Sketch a diagram that shows the "web" of values and how stakeholders interrelate.)

STUDENT WORK. An example in-class deliverable representing web of stakeholders and values (left) and stakeholder values (right).

CO-EVOLUTION OF TECHNOLOGY AND SOCIAL STRUCTURE

Value sensitive design makes a commitment to an *interactional stance*, which refers to the idea that stakeholders shape the design and use of technology and, in turn, technologies shape stakeholders and society. Accordingly, value sensitive design proposes that both technical and policy elements be considered in technical and engineering design processes.

Each of the case studies, therefore, prompts students to consider both technology and policy elements. Technical elements include system requirements and features, functional capabilities, form factors, physical and logical organization of system components, and so forth. Policy elements include laws, norms and community standards, rules governing allowable and prohibited uses, incentive systems, and forth. Considering both technical and policy elements, expands the design space and positions students to broadly examine the sociotechnical setting.

In-class student activity: Frame the design space through the co-evolution of technology and social structure.

Focus and questions: In the same design space, consider both technical and policy elements. How can both elements be considered together? How do they interrelate?

TECHNICAL REQUIREMENTS

1. The Health Insurance Portability and Accountability Act (HIPM) guidelines are followed to keep data secure.
2. To reduce data entry errors, all drug names are highlighted, described, and fast v. slow acting versions shown with contrasting typography.
3. Patient-centered reports, listing drug names, purposes, and interactions among drugs on the list can be generated by doctors.

SOCIAL ELEMENTS

1. **Incentive system:** To avoid errors, doctors are penalized when data entry errors are identified.
2. **Code of conduct:** To avoid errors, doctors and patients jointly review all drug list reports at least once/year.

Method panel 3. Brief example of engaging social and technical elements together when co-evolving technology and social structure. (*Suggested activity:* Explore the relationships between the technical requirements and the social elements. What implications for design follow?)

VALUE SCENARIO

Value scenarios are an envisioning technique for surfacing stakeholder perspectives related to values and technology use. Value scenarios take the form of written hypothetical narratives where stakeholders engage with technologies. Value scenarios are often like a good short story: A protagonist, with motivations and a background, seeks a goal, encounters obstacles, and ultimately gets to some kind of resolution, possibly unsatisfactory. The narrative path generally focuses on the value implications of technology, potential benefits and harms, and unintended consequences. Typically, value scenarios focus on direct and indirect stakeholders, value tensions, and longer-term implications of a hypothesized technology. Value scenarios can be fairly short (50-200 words) or a good deal longer.

In the case studies, students are often prompted to crystalize their technical and policy options in a 200-word value scenario. The following is an example of a relatively detailed value scenario, which has been shortened from the published version and lightly edited (Czeskis, Dermendjieva, Yapit, Borning, Friedman, Gill, & Kohno, 2010):

Hypothesized technology. Feeling safe and self-assured Mobile parenting technology. uSafe is a hypothetical mobile phone application and free service developed to collect and store potential evidence and forensic information. Once installed on a mobile phone, uSafe allows the user to send text messages and photographs to a uSafe server. In turn, uSafe retains this information for six months and will only release it under a court issued warrant. Without a warrant, even users cannot access or inspect the information they have sent to a uSafe server.

Scenario. Fifteen and self-assured, Naomi is thrilled with the feeling of independence that comes with starting high school. She spends her days in a flurry of classes and extracurricular activities ... Her older friends at school offer to give Naomi rides back and forth, and when she isn't accepting rides, she likes to walk, ride her bike or take the bus. Naomi's parents are happy that their daughter has made a smooth transition to high school and is responsibly taking charge of her own life, but they are having a difficult time with seeing less of Naomi and keeping track of her whereabouts.

One evening, Naomi leaves a play rehearsal after dark and decides to take the bus to the mall, where her friends have gathered to eat pizza and see a movie. Naomi's parents have given her the OK to do so, and are aware of which bus she is taking. During the bus ride, a strange man stares at Naomi. When she gets off of the bus at the stop by the mall, the man does also. She gets the uncomfortable feeling that he is following her, but isn't sure what to do about it; he is not overtly threatening and she feels she cannot call the police just to report feeling unsafe. She makes it to the mall without any incident, but has been frightened by the thought of being in danger. When she gets home later that night, Naomi recounts the story to her parents, who are understandably concerned. Neither Naomi nor her parents want to curtail her activities or her freedom; there have been no problems until now and Naomi has been managing her schedule well otherwise. Naomi and her parents wonder if there could be some light-weight way that she could signal them if she found herself in over her head, before a true emergency situation arises.

Naomi's mom sees uSafe featured on the evening news. It sounds like just the thing to provide some peace of mind. So she proposes uSafe to Naomi. Naomi likes it too - especially the fact that the uSafe design puts notification under her control. Naomi feels like she now has a way to keep in contact with her parents without sacrificing any of her freedom or autonomy. She can use uSafe when she feels the need and she doesn't have to feel as if her parents are monitoring her unnecessarily.

Method panel 4. Example value scenario. (Suggested activity: Underline the values and direct and indirect stakeholders. How does the narrative clarify what is at stake with this proposed technology?)

OTHER METHODS

In summary, the case studies present design briefs and a suggested design process that prompts students to employ:

- Direct and indirect stakeholder analysis
- Value source analysis
- Co-evolution of technology and social structure
- Value scenarios.

These methods are most often brought together around familiar skills and practices in design thinking, such as:

- Approaches in divergent brainstorming
- Approaches to making choices and documenting assessments with rationale
- Affinity diagramming
- Good use of Post-It Notes and whiteboards
- Summarizing design work with sketches and simple posters.

STUDENT WORK. An example in-class deliverable representing technical design features and strengths and weaknesses (left) and the values held by direct and indirect stakeholders (right.)

NOTES

For a review of methods in value sensitive design and the foundational studies where they were developed and employed, see Friedman, Hendry and Borning (2017) and Friedman & Hendry (2019).

For more detail on direct and indirect stakeholders, see Friedman, Kahn, Hagman, Severson and Gill (2006).

For more detail on value source analysis, see Borning, Friedman, Davis, and Lin (2005).

For more detail on co-evolution of technology and social structure, see Miller, Friedman, Janicke, and Gill (2007).

For more examples of value scenarios, see Czeskis, Dermendjieva, Yapit, Borning, Friedman, Gill, and Kohno (2010). Values scenarios can also be expressed in video format (see, for example, Woelfer & Hendry, 2009).

For a very thorough discussion of the values and value tensions related to physicians and patients of electronic health records see Grünloh (2018) and Grünloh, Myreteg, Cajander & Rexhepi (2018).

REFERENCES

Borning, A., Friedman, B., Davis, J., & Lin, P. (2005). Informing public deliberation: Value sensitive design of indicators for a large-scale urban simulation. In H. Gellersen, K. Schmidt, M. Beaudouin-Lafon, & W. Mackay (Eds.), *ECSCW 2005* (pp. 449–468). Dordrecht: Springer. http://doi.org/10.1007/1-4020-4023-7_23

Czeskis, A., Dermendjieva, I., Yapit, H., Borning, A., Friedman, B., Gill, B., & Kohno, T. (2010). Parenting from the pocket: Value tensions and technical directions for secure and private parent-teen mobile safety. In *Proceedings of the Sixth Symposium on Usable Privacy and Security* (pp. 15:1–15:15). New York, NY: ACM. http://doi.org/10.1145/1837110.1837130

Friedman, B., Hendry, D. G., & Borning, A. (2017). A survey of value sensitive design methods. *Foundations and Trends in Human-Computer Interaction*, *11* (23), 63–125. http://dx.doi.org/10.1561/1100000015

Friedman, B., & Hendry, D. G. (2019). *Value Sensitive Design: Shaping Technology with Moral Imagination*. Cambridge, MA: MIT Press.

Friedman, B., Kahn, P. H., Jr., Hagman, J., Severson, R. L., & Gill, B. (2006b). The watcher and the watched: Social judgments about privacy in a public place. *Human-Computer Interaction*, *21*(2), 235–272. http://doi.org/10.1207/s15327051hci2102_3

Grünloh, C. (2018). *Harmful or empowering? Stakeholders' expectations and experiences of patient accessible electronic health records*. Doctoral Thesis, KTH Royal Institute of Technology, School of Electrical Engineering and Computer Science Media Technology and Interaction Design, Stockholm, Sweden. ISBN 978-91-7729-971-4.

Grünloh, C., Myreteg, G., Cajander,Å., and Rexhepi, H. (2018). "Why Do They Need to Check Me?" Patient Participation Through eHealth and the Doctor-Patient Relationship: Qualitative Study J*ournal of Medical Internet Research*, *20*(1), 1-15. http://doi.org/10.2196/jmir.8444

Miller, J. K., Friedman, B., Jancke, G., & Gill, B. (2007). Value tensions in design: The value sensitive design, development, and appropriation of a corporation's groupware system. In *Proceedings of the 2007 International ACM Conference on Supporting Group Work* (pp. 281–290). New York, NY: ACM. http://doi.org/10.1145/1316624.1316668

Woelfer, J. P., & Hendry, D. G. (2009). Stabilizing homeless young people with information and place. *Journal of the American Society for Information Science and Technology*, *60*(11), 2300–2312.

3

“Drones Okay”

PLAYGROUND: FUN WITH PERSONAL DRONES

Learners consider the sociotechnical aspects of drones and how drones can restructure social experiences. Learners are prompted to design a playground, where drones can be used safely for fun and recreation, while other playground activities are also accommodated. The learning aims of this case study are to:

1. Introduce Unmanned Aircraft Systems (UAS), commonly referred to as drones, as a rapidly evolving sociotechnical phenomenon
2. Develop skills for direct and indirect stakeholder analysis, especially considering bystanders
3. Explore how both technical and policy requirements might be developed to support multi-use stakeholder experiences.

INTRODUCTION

Unmanned Aircraft Systems (UAS), also referred to as Unmanned Aerial Vehicles (UAV) and commonly known as "drones," are poised to have a substantial impact on human societies. In this case study, "drone" refers to all remote controlled, or autonomous, unmanned aircraft systems, regardless of size, capabilities, or purpose. Drones are commonly equipped with cameras and perhaps other sensors. Drones were first developed for military applications at the beginning of the 20th century, shortly after the development of manned aircraft. More recently, drone technology has begun to diffuse into governmental and non-governmental institutions—for example, police departments and movie studios—and into the hands of individuals for both personal and commercial applications.

Despite federal regulations that prohibits people from flying drones in Washington, D.C., on January 26, 2015 a small, inexpensive, personal drone penetrated security and crash landed on the White House grounds in Washington, DC. Responding to reporters' questions the next day, President Obama was reported to have said: "We don't really have any kind of regulatory structure at all for [drones]." It was further reported that he asked government agencies to make sure that drones "… aren't dangerous and that they're not violating people's privacy."

At the same time, state legislatures around the U.S. have also been concerned about the use of drones. For example, on December 1, 2015 the Georgia House of Representatives released a report, "House Study Report on the Use of Drones," which began with this sentence: "Commonly referred to as drones or unmanned aircraft systems (UAS), this technology is taking the nation by storm; however, regulations for their use have fallen behind." Here are the 15 recommendations from the Georgia House of Representatives:

1. Continue to monitor FAA Regulations with regards to registration requirements of hobbyist operators. The committee does not want to duplicate the process or hinder the industry.

2. Form a commission made up of legislators, researchers, industry experts, and others deemed appropriate to help develop policy and encourage industry expansion within the state.

3. Continue to encourage our universities and technical colleges to find ways to get involved by offering classes, certifications, or any other opportunities that may be deemed necessary.

4. Encourage the state and its agencies to use drone technology in areas where it could provide a cost savings or improve safety.

5. Look for opportunities to encourage venture capitalists to help with startups in Georgia.
6. Protect citizen privacy by making it unlawful to video or photograph another person's property without permission with limited exceptions to this.
7. Prohibit weaponizing a drone.
8. Make it a violation to fly in or around certain locations such as the capitol.
9. Allow local governments to restrict the use of drones on their publicly owned land.
10. Make it unlawful to fly around or to interfere with an emergency scene or to interfere with public safety personnel carrying out official duties.
11. Require law enforcement to have a search warrant to use drones in areas to collect evidence where someone has a reasonable expectation of privacy.
12. Require any videos or photos taken of private property by a government entity without evidentiary value to a specific case to be purged.
13. Make it unlawful to take off from or to recover a drone from private or public property without permission.
14. Prohibit use of drones for hunting and fishing or to use a drone to interfere with someone else that is hunting, fishing, or trapping.
15. Prohibit the use of drones within so many feet of a public road without permission.

How might the President's call for action be addressed? Consider the value of "safety." One approach is to design drones with restricted technical capabilities, which promote safety. For example, a drone's flight altitude might be limited by sensor and control chip, thereby generally keeping the drone separated from manned aircraft. This is a technical approach. Another approach is to develop regulations for where and how drones can be flown and to penalize operators who violate the regulations. For example, the Federal Aviation Administration prohibits the operation of unmanned aircraft systems within 30-mile radius of Ronald-Reagan Washington National Airport, which includes the District of Columbia. This is the policymakers' approach. Often policy and technical design go hand in hand. As a simple example, a law (policy element) might be passed that prohibits the modification of altitude sensors and controllers (technical element) on drones.

DESIGN ACTIVITY

Design Prompt

Suppose you have been contracted by a community organization to develop a plan for a "Drones Okay" playground. Your goal is to design such a playground. Consider the activities that the playground will support and not support. Develop both the technical requirements of the playground and the drones, and the rules for using the playground.

Design Setting

Before beginning with a design project—even a short classroom exercise—it can be helpful to consider the framing assumptions. That is, things about the project that are accepted as true. Often enough, a project's framing assumptions are presupposed, implicit, or even somewhat obscure. A lot is unsaid in the above prompt; for example: Where is the playground located? Who in the neighborhood uses the playground? What activities take place in the playground? Is there a daily or seasonal rhythm to how the playground is used? And so on.

When seeking to move a design process forward a reasonable strategy is to identify as many questions about the design situation as possible and to answer those questions by making reasonable assumptions. In a similar vein, to fill in the gaps of a design prompt, it can be helpful to make reasonable clarifications. Sometimes, a designer will even re-write the design prompt with a "better" prompt, albeit, ideally, with a prompt that honors the spirit of the original. (Of course, in an actual project, with a budget of time and money, you would conduct empirical work—interviews with project sponsors and other stakeholders, careful observation of the playground, and so on—in order to identify the framing assumptions.)

In the prompt, "Drones Okay" is an element that needs clarification. A "Drones Okay Playground" seems to be different than a "Drones Only Playground." That is, "Drones Okay" seems to mean that drones can be flown but other activities—sliding, swinging, ball throwing, messing around in the sandbox—might continue to take place. If so, the question might be: How might the playground be re-designed to absorb the activities of a drone?

Stepping back further, someone, for some reason, has decided that a "Drones okay" playground is a good idea. Or, least, someone has decided to investigate its merits. But, why?

Perhaps, a local political leader repeatedly observed teenagers flying drones at a park and has seen the potential for conflict arise with dog walkers, young children, and great blue herons who nest nearby in the spring. Rather than an outright ban on drone flying, which might be called for in other contexts such as, for example, a natural wilderness area, she has sought an accommodation.

Is an accommodation possible? After following a design process, perhaps the answer is "yes," within limits, or perhaps, no acceptable approach is identified, and the best solution is to ban drones. In any case, it seems likely that all solutions will be contestable, with better or worse solutions rather than right or wrong solutions.

Another assumption is that playgrounds are "public spaces," which, stepping back further, reflect multiple community traditions. When considered as such, we encounter deep questions concerning "norms," that is, standards, expectations, and etiquette. Again, in a 3-week or longer project, identifying the particular norms related to how the playground is used would require empirical work.

In the face of multiple uses for outdoor, public playgrounds—and new uses at that—how might social harmony be achieved? That is, how might particular technical and policy elements be developed to minimize multiple conflicting uses?

On the one hand, stakeholders might hold the conviction that playgrounds should be protected from new technologies, which are likely to disrupt ball throwing, playing in the sandbox, swinging, and other traditional activities. Like mosquitoes, drones can be pesky, flying in erratic patterns, with rapid and unpredictable shifts of direction and height. With cameras and flashing lights, drones extend the reach of a pilot, providing easy means to violate social norms related to personal space and privacy. Drones, in short, are often rude because pilots can readily violate the presumed right for bystanders to be left alone. Exacerbating matters, in some communities, for example minority communities, surveillance might be a deep, longstanding concern, leading to anxiety about drones that have cameras.

On the other hand, stakeholders might hold the conviction that drones are fun and that playgrounds are an appropriate place for flying, at least within limits. Here, the value to be explicitly supported might be "transcendence"—creating a coherent bridge between older, accepted activities and new ones. Beyond the freedom to fly, society might also benefit when drones are de-mystified, and citizens develop experience-based intuitions about their benefits and harms. Widespread practical knowledge for drones will position society to move forward with better public deliberation about appropriate uses of drones and acceptance of new application areas.

In summary, as you work through the following design process, seek to clarify the framing assumptions, explore the convictions that people might hold for playgrounds, and seek to surface and examine the underlying values of these convictions. Then, use the faming assumptions, convictions, and values to inform and shape your design work.

Design Process

To guide your design process, follow these six steps in order. (Note that while these steps are ordered linearly, time allowing, you might go back-and-forth between steps iteratively and integratively.)

1. **Direct and indirect stakeholder analysis.** Identify a list of stakeholders who might use the playground. Note how they would experience the playground or be affected by others' activities. Then, select two direct and two indirect stakeholders for further analysis. Direct stakeholders are people who interact with drones in the playground, such as a child pilot, flying the drone in front of a swing set. Indirect stakeholders, often bystanders, are people who, while not operating or directly interacting with a drone, are nevertheless impacted by a drone. An example might be a grandparent whose attention is distracted by a buzzing drone while reading a newspaper and minding his grandchild.

2. **Value source analysis.** For your direct and indirect stakeholders, consider their values. To do so, consider their likely interests in the playground and in drones. What views and underlying values do they hold? Some values to consider: fun, challenge, learning, privacy, safety, quietness. How are the various stakeholder values in tension—for example, "fun" v. "safety"? As a designer, what are your values? What values might you explicitly design for? One approach, for example, might be to create a playground in which stakeholders "respect" and "tolerate" each other.

3. **Envision the sociotechnical context**. Draw a labeled sketch of the playground. What features would make up the playground and what changes, if any, would you make to accommodate drones? How might drones be used to interact with those features? Some things to consider: Wood chips, trees, swings, fences, signage, hidden passageways, lookout towers, and so on.

4. **Policy design.** Write a policy statement, perhaps a list of rules, of allowable and prohibited rules at the playground. Your policy statement might begin: *To have fun and fly safe you should….* Some things to consider: When would the playground be open? Who would be encouraged to play? What rules would regulate allowable and prohibited ways of flying?

5. **Technical design.** What kind of drones would be allowable in the playground? What capabilities would they have? How would the technical capabilities support your policy design? What specific features related to the playground, if any, would the drones have? Write a set of technical requirements, in the form of: *The [drone | playground] shall …*

Your Presentation

Draw a sketch of your playground, showing your direct and indirect stakeholders. Bring forward some of your key technical requirements and the key aspects of your policy statement.

Prepare a 2-minute summary of your design. Describe how your technical requirements and policy design work together to create a safe and fun playground.

Discussion Questions

1. How, if at all, did your policy and technical design work together, with one supporting the other?
2. How did the indirect stakeholders influence your design? Did you consider non-human, indirect stakeholders?
3. What values motivated your design choices and how were they taken into account in your design?
4. What Federal, State, or local laws and regulations might you need to take into account in your design?
5. Do you see any connections between the design of the "Drones Okay" playground and the list of 15 recommendations from Georgia House Study Report on the Use of Drones? What elements of your technical and policy design might be appropriated or re-used to address some of the recommendations?

INSTRUCTOR NOTES

The case study is written with the "Drones Okay" Playground design prompt. Three other design prompts are given below. Select one of the design prompts and adjust the suggested design process as needed.

REFLECTIVE WRITING PROMPTS AND EXERCISES

1. **Write a value scenario.** Write a 500-word value scenario that crystallizes your design work. Consider the direct and indirect stakeholders, their values, and how your design addresses possible value tension that emerge.

2. **Your design process.** Write a 500-word reflective statement on your design process, focused on how your policy and technical design worked together or on how indirect stakeholders influenced your design.

3. **Envisioning future uses of drones.** Consider this recommendation from the Georgia House Study Report on the Use of Drones: *Prohibit use of drones for hunting and fishing or to use a drone to interfere with someone else that is hunting, fishing, or trapping.* How specifically might Georgia law be updated to address this recommendation? Can you find examples from U.S. states that have passed laws that address this recommendation? Speculating, what might such laws tell us about U.S. society? Write a 500-word report.

4. **Geo-fences.** Investigate implementation approaches for Geo-fences. How might Geo-fences be used to address some of the recommendations from the Georgia House Study Report on the Use of Drones? What might the benefits and costs of Geo-fences be?

5. **Character and focus of drone recommendations.** Examine the list of 15 recommendations from the Georgia House Study Report on the Use of Drones." Propose 3–5 categories for organizing the recommendations and give rationale for your choices. *Hint*: Some recommendations appear to lead to regulations that will be constraining whereas others give a mix of boundaries and opportunities. Some recommendations are quite specific, others are quite broad and perhaps somewhat vague. Some recommendations concern human activities, some concern geography. Some recommendations are focused on how and where drones can be flown whereas others are concerned with drones' capabilities. Some recommendations have implications for drones as devices whereas others seem to have implications for the information infrastructure that supports drone operations.

ADDITIONAL DESIGN PROMPTS

The suggested in-class design process – namely, (1) Direct and indirect stakeholder analysis, (2) Envision the sociotechnical context, (3) Policy design, and (4) Technical design – could be adapted to engage other design problems. Here are three additional design prompts:

- **Drone registration.** In February 2016, the Federal Aviation Administration Administrator, Michael Huerta, was reported to have said "We need to bring the unmanned aircraft enthusiasts into the culture that has characterized aviation throughout its history – that is a culture of safety and a culture of responsibility." Propose a registration system that would promote a culture of "safety," "responsibility," and "accountably." How might drones, direct stakeholders, and indirect stakeholders interact with the registration system?
- **Drone airspace firewalls.** How might a property owner control her airspace from unwanted intrusions by drones. Using geo-fences as a technical approach, develop a policy recommendation and technical design approach. Some questions to consider: i) What kind of property would your policy recommendations cover? ii) How might exceptions be supported (e.g., a friend's drone, a package delivery drone)? iii) What existing laws would your policy recommendations need to work within?
- **Drone identity.** A homeowner unexpectedly encounters a drone at the window of her 26th floor apartment. Startled, she does not recognize the drone and has no idea why it is there. She can't ask the drone and she can't see anyone below who looks to be operating the drone. She wonders: Is this drone voyeurism? How might policy design and technical design, if at all, address such situations? Some questions to consider: i) How might the drone be given an identity? ii) How might bystanders communicate with drones and their operators and, if they could, what would they say? iii) At what point do bystanders change from being indirect stakeholders to being direct stakeholders who seek to interact with a drones.

NOTES

Introduction

1. dronelife collects stories and commentary on recent developments in drones. The Center for the Study of the Drone investigates the opportunities and challenges of unmanned technologies in both the military and civilian sphere. The Association for Unmanned Vehicle Systems International is a professional organization committed to fostering, developing, and promoting unmanned systems and robotic technologies.

2. For a comprehensive introduction to drones, see Clarke (2014). Regulatory information on where and how drones can be flown can be found at the Federal Aviation Administration.

3. For a brief history of military drones, see Cook (2007) and Shaw (2012). For an introduction to drone warfare and the law of armed conflict, see Vogel (2011). For an account of what its like to be a military drone operator, see Power (2013).

4. For an account for personal drones using value sensitive design as an analytic tool, see Hendry (2017).

Background: Drones, Safety and Privacy

1. For an account of the drone crash on the White House grounds, see Schmidt (2015) and Shear & Schmidt (2015). The White House released a presidential memorandum on drones, focused on economic competitiveness, privacy, safety, and civic rights.

2. The Georgia House of Representatives report containing the 15 recommendations on the use of drones is available: House Study Committee on the Use of Drones.

Reflective Writing Prompts and Exercises

1. NoFlyZone.org enables property owners to set up geo-fences to keep out drones. Newman (2015) provides an introduction to a vision where geo-fences are deployed by institutions and individuals to protect privacy rights. Skyward is a startup that provides geo-fencing capabilities and related services for drone operations.

2. Virginia was the first state to pass a drone law in April 2013. In 2015, 45 states considered over 150 bills related to drones. For an overview of state laws related to drones, see the National Conference of State Legislators.

Additional Design Prompts

3. The Federal Aviation Administration has created a drone registration system. As of February 2016, the number of drones that been registered with the FAA exceeds the number of registered piloted aircraft (320,000). For early reporting on the the idea of a drone registration system, see Wingfield (2015). For information on the FAA process for creating the registration system, see FAA-2015-4378-0022.

4. NoFlyZone.org provides a service where individual property owners can register drone no fly zones. Also, see Newman (2015).

5. For an account of the woman who saw the drone outside her 26th floor apartment and what she did, see Bever (2015).

REFERENCES

Association for Unmanned Vehicle Systems International. (n.d.). Retrieved February 7, 2016, from http://www.auvsi.org/home

Bever, L. (2014, June 14). Seattle woman spots drone outside her 26th-floor apartment window, feels "violated." *The Washington Post*. Retrieved from https://www.washingtonpost.com/news/morning-mix/wp/2014/06/25/seattle-woman-spots-drone-outside-her-26th-floor-apartment-window-feels-violated/

Center for the Study of the Drone. (n.d.). Retrieved February 7, 2016, from http://dronecenter.bard.edu

Clarke, R. (2014). Understanding the drone epidemic. *Computer Law & Security Review*, *30*(3), 230 – 246. http://doi.org/http://dx.doi.org/10.1016/j.clsr.2014.03.002

Cook, K. L. B. (2007). The Silent Force Multiplier: The History and Role of UAVs in Warfare. In *2007 IEEE Aerospace Conference* (pp. 1–7). http://doi.org/10.1109/AERO.2007.352737

DRONELIFE. (n.d.). Retrieved February 7, 2016, from http://dronelife.com

Friedman, B., Kahn Jr., P. H., & Borning, A. (2006). Value sensitive design and information systems. In P. Zhang & D. Galletta (Eds.), *Human-computer interaction in management information systems: Foundations* (pp. 348–372). Armonk, NY: M.E. Sharpe.

Jansen, B. (2016, February 8). FAA: Drone registration eclipses that of regular planes. *USA Today*. Retrieved from http://www.usatoday.com/story/news/2016/02/08/faa-drone-registration-eclipses-regular-planes/80002730/

Hendry, D. G. (2017). Personal drones and value sensitive design. In P. Otto and E. Gräf (Eds.), 3*TH1CS: The Reinvention of Ethics in the Digital Ag*e (pp. 58-66). Berlin, Germany: iRights. Media.

Hightower, D., Lumsden, E., Prince, B., & Watson, S. (n.d.). *House Study Committee on the Use of Drones*. Georgia House of Representatives. Retrieved from http://www.house.ga.gov/Documents/CommitteeDocuments/2015/Drones_FINAL_REPORT.pdf

Newman, L. H. (2015, February 10). Here's How to Set Up a No-Fly Drone Zone Over Your House. Wired. Retrieved from https://slate.com/technology/2015/02/noflyzone-org-lets-you-geofence-the-area-over-your-house-for-drones-to-avoid.html

Power, M. (2013). Confessions of a Drone Warrior. *GQ*. Retrieved from http://www.gq.com/story/drone-uav-pilot-assassination

Presidential Memoranda. (2015, February 15). Presidential Memorandum: Promoting Economic Competitiveness While Safeguarding Privacy, Civil Rights, and Civil Liberties in Domestic Use of Unmanned Aircraft Systems. Retrieved from https://obamawhitehouse.archives.gov/the-press-office/2015/02/15/presidential-memorandum-promoting-economic-competitiveness-while-safegua

Schmidt, M. S. (2015). Secret Service Arrests Man After Drone Flies Near White House. *New York Times*. Retrieved from http://www.nytimes.com/2015/05/15/us/white-house-drone-secret-service.html?_r=0

Shaw, I. (2012). The Rise of the Predator Empire: Tracing the History of U.S. Drones. Retrieved from https://understandingempire.wordpress.com/2012/10/28/essay-the-historical-rise-of-the-predator-drone-2/

Shear, M., D., & Schmidt, M., S. (2015). White House Drone Crash Described as a U.S. Worker's Drunken Lark. *New York Times*. Retrieved from http://www.nytimes.com/2015/01/28/us/white-house-drone.html

Vogel, R. J. (2011). Drone Warfare and the Law of Armed Conflict. *Denver Journal of International Law and Policy*, *39*(1).

Wingfield, N. (2015, October 19). Regulators Propose a Drone Registration System. *New York Times*. Retrieved from http://www.nytimes.com/2015/10/20/business/regulators-propose-a-drone-registration-system.html

4

Workforce Management

SCHEDULING CALL-CENTER WORKERS

Students are positioned to consider the regulation of Workforce Management Systems. These systems draw upon predictive analytics—big data sets, machine learning, and optimization algorithms—to forecast worker demand and to schedule workers into shifts, subject to employment laws, business rules, worker preferences, and other constraints. Students explore how forecasting and scheduling algorithms can lead to unstable and unpredictable work schedules. Such schedules, while perhaps economically advantageous to business, might negatively impact the wellbeing of workers and their families with potentially major implications for the public interest.

INTRODUCTION

Timers, clocks, stop watches; the work hour, the shift, the schedule: For hundreds of years such tools have been used to guide, and often control, the rhythms of work and everyday social life.

Employers depend particularly on schedules. Schedules essentially forecast the amount of work needed to be done and organize workers to carry out the work at set times. But workers, quite obviously, have multi-faceted lives and identities, with roles outside of work—student, parent, caregiver, for example. A work schedule, especially one that changes frequently and unexpectedly, might make it difficult to fulfill such roles, with consequential ripple effects throughout society.

So called "crazy" schedules can wreak havoc on the personal lives of workers in high paying jobs. People on video game development teams, for example, often work 100-hour work weeks during "crunch time." Investment bankers, and their staffs, often need to be continuously on call for several weeks when finalizing a business deal. The impact of problematic work schedules is likely to be even more acute for workers in low wage jobs, such as restaurant, retail, and call center workers, jobs often held by women and ethnic minorities.

Consider this advertisement, which promises worker input into the creation of work schedules:

Job: Retail Sales, *Flexible Scheduling Option!*, Part-Time

Opportunity:

This position uses a scheduling plan that allows an associate to participate in the creation of his/her work scheduling by managing availability and identifying a preferred work schedule. This position allows the maximum amount of scheduling flexibility.

Qualifications:

Ability to work a flexible schedule, including mornings, evening, and weekends, and busy events such as the day after Thanksgiving, special Big Event days, and the day after Christmas, based on department and store/company needs.

The key term is “flexibility,” that is, allowing the worker to create a schedule that meets his or her preferences. Things get murky, however, in the qualifications section of the ad, where we read that the employee should have the ability to “work a flexible schedule.” In short, even in this ad, we can see that the employee’s and the employer’s view of “flexibility” appear to be quite different. What is at stake with this apparent tension and how might it be addressed?

Workforce Management Systems make flexible scheduling on an hour by hour basis feasible. One key component of these systems is a forecasting algorithm. Based on machine learning techniques and large amounts of data, the forecasting algorithm enables these systems to precisely forecast the business’s staffing needs. The inputs to the forecasting algorithm might include historical data on sales, current events, weather forecasts, advertising campaigns, social trends, or for that matter, any kind of data. The forecasting algorithm is a learning algorithm because the algorithm learns how to weight particular features in the data sources, which in turn, allows the algorithm to improve its forecasts.

Consider how the forecasting algorithm might work if, hypothetically, it was deployed in a local coffee shop. At the beginning of a week, the algorithm might predict that the shop will be extremely busy on Thursday, between 6:45 - 9:00 P.M., because the evening weather is expected be cool but dry, the high-school football game will finish around 6:30 P.M., a sales coupon promotion will end on Friday, and since Thursday evenings are normally busy, even without taking into account the nice weather and the game.

The forecasting algorithm might look ahead 10 days, slicing staffing needs into 15 minutes intervals for all opening hours, and create a forecast. Further, seeking the best possible forecast, the algorithm scans for new data, updates worker attendance figures and, in turn, updates its forecast every hour.

While such forecasting is perhaps not needed for a single, small, independent shop, the economic benefits seem compelling if the coffee shop was one franchisee of many hundreds, if the software was managed centrally, if the software was designed to take local conditions and data sources into account, if available workers were distributed across a region with several such franchisees, and if the software was known to support worker’s conceptualization of “flexibility.” Clever and robust labor forecasting algorithms, in other words, might give a retail business with many stores competitive advantage.

Workforce Management Systems also schedule workers. The scheduling algorithm is a kind of optimization algorithm. Optimization algorithms seek to maximize an "objective function," subject to a set of constraints. In this case the objective function might be profit, that is, sales minus costs per shift, and one key constraint is, of course, to meet the staffing need forecast. Other kinds of constraints might include:

1. Employment laws, such that no part-time worker can work more than 20 hours in week
2. Worker preferences, such as times when a worker is available or not available
3. Business rules, such that a mix of both experienced and inexperienced workers are on every shift
4. Unexpected contingencies such that a worker gets sick and will not make a shift or misses the bus and so will be tardy.

In addition to such constraints, the scheduling algorithm might use other data sources related to worker performance. For example, data related to the likelihood that the worker will show up to his or her shift, past sales performance, and customer satisfaction feedback. All of this data, and much more, might plausibly be used by the algorithm to obtain an optimal match of workers to shifts.

The forecasting and scheduling algorithms, at least in one view, turn the coffee shop into a kind of a demand and response machine. As forecasted demand for workers comes and goes, the machine responds, scheduling workers into shifts. The algorithm might send messages to workers about last minute shift openings, incentivizing workers with extra pay. Or, workers might bid on shifts through auctions. Or, workers might be compelled to take shifts to avoid penalties such as fewer hours in the future.

In a different vein, note that some crucial information might only be collected by surveilling employees or at least by invasive monitoring; for example, what workers say and do on the job, where workers live and how they travel to work, and so on. Perhaps data on workers' sleep patterns and indicators of psychological well-being are decisive, substantially improving the forecasting and scheduling algorithms. There appear to be few, or perhaps no, technical limits on what data might be sensed and collected. But as a matter of human dignity or of the public interest, perhaps some data should not be collected and used by algorithms.

Returning to the value of "flexibility," Workforce Management Systems are likely to create more profitable schedules if all workers are always "on call" and available to work. This is so because, in general, with fewer constraints, the scheduling

algorithm has more options for finding the optimal mix of workers for any given shift. So, from a business or corporate point of view, the definition of "flexibility" is one related to the availability of workers. But, for workers work becomes unpredictable and unstable. In the last two decades major retailers changed their worker status, from about 75% full-time workers to about 25% full-time.

The trouble with this view of "flexibility" is that the public interest is pushed to the background. Workers have duties, aspirations, and lives outside of work. But, week-to-week schedules have serious ripple effects for workers. The New York Times, for example, reports on the challenges of a single mother working part-time. In the absence of a stable work schedule, organizing childcare and attending classes become extremely difficult.

Addressing the problem, Congress proposed legislation, known as the Schedules That Work Act. The opening paragraphs of the bill summary (H.R.5159 — 113th Congress, 2013-2014) are as follows:

Schedules That Work Act - Grants an employee the right to request that his or her employer change the terms and conditions of employment relating to:

(1) the number of hours the employee is required to work or be on call for work;

(2) the times when the employee is required to work or be on call for work;

(3) the location where the employee is required to work;

(4) the amount of notification the employee receives of work schedule assignments; and

(5) minimizing fluctuations in the number of hours the employee is scheduled to work on a daily, weekly, or monthly basis.

The Schedules That Work Act ...

- Requires the employer, if the request is made, to engage in a timely, good faith interactive process with the employee that includes a discussion of potential schedule changes that would meet his or her needs.
- Outlines the process for either granting or denying a change.
- Requires the employer to grant a request, unless there is a bona fide business reason for denying it, if the request is made because of the employee's serious health condition, his or her responsibilities as a caregiver, or enrollment in a career-related educational or training program, or if a part-time employee requests such a change for a reason related to a second job.

DESIGN ACTIVITY

Design Setting

Assume that you are part of a technology team. Your team has extensive expertise in predictive analytics—big data systems, machine learning, and optimization algorithms—with specialized knowledge for labor forecasting and workforce scheduling.

You have been hired to develop a Workforce Management System for scheduling call-center workers. The Workforce Management System has two main modules: (1) A forecasting algorithm; and (2) A scheduling algorithm.

Key features of the design setting include:

- Workers at the call-center help callers with their questions about a range of products - different workers have different areas and levels of expertise
- The call center is open from 5 A.M. Pacific to 10 P.M. Pacific
- Workers at the call-center work out of several different offices located in different regions and time zones of the U.S.

Design Prompt

Your goal is to outline a policy document for regulating the Workforce Management System. You'll need to address both the forecasting and scheduling algorithms. The policy document should comprise a list of requirements, focused on:

- Allowed and prohibited data sources
- Worker and employer constraints that are allowed be considered
- How conflicts between workers and employers will be handled

Design Process

To develop the requirements, you should follow the following process:

1. **Value scenario.** Consider the life circumstances of a call-center worker. Concretely, write a 150-word story, focused on a single worker. The story, called a value scenario, should focus on what it might be like to be a call-center worker who balances call center work and other life responsibilities and aspirations. Consider especially aspects of time and scheduling outside of work. For inspiration you might consider a student who is attending college, a retired, elderly man or woman, or a high school student on summer break. The person of focus could be anyone. You choose. (Optional: For background, and time permitting, read Kantor, 2014).

2. **Direct and indirect stakeholder analysis.** Based on your value scenario, and reflections about the call worker and their social context (i.e., their family, friends, and other relationships), identify the direct and indirect stakeholders and briefly discuss their point of views. A direct stakeholder directly interacts with a technology (e.g., entering scheduling preferences, viewing a work schedule, etc.) whereas an indirect stakeholder is impacted by a technology but does not directly interact with it (e.g., a young child might be impacted by a change in his parent's work schedule).

3. **Policy design.** Given your value scenario and direct and indirect stakeholder analysis, propose a set of requirements for the forecasting and scheduling algorithms. The requirements should be written as follows:

    a. The forecasting algorithm may, or may not, consider data source X1, X2, … Xn.

    b. The scheduling algorithm should consider the following worker constraints, in order of importance: X1, X2, … Xn.

    c. The scheduling algorithm should consider the following employer constrains, in order of importance: X1, X2, … Xn.

    d. When conflicts between workers and employer constraints occur, they will be handled as follows: ….

Presentation

Prepare a 5-minute presentation where you:

1. Read your value scenario

2. Identify and briefly discuss one indirect stakeholder

3. Introduce 1-2 requirements, focusing on the policy goals and how the requirements are intended to shape the algorithms.

REFLECTIVE WRITING PROMPTS AND EXERCISES

1. **Your design process.** Write a 500-word reflective statement on your design process. You might focus, for example, on how your value scenario framed your thinking or how considering indirect stakeholders lead to certain kinds of requirements.

2. **Policy proposal.** Based on your group work, write up a policy proposal. In your write-up, (a) summarize your design process; (b) present your value scenario and stakeholder analysis; (c) present your requirements; and (d) present your next steps. In your proposal pay special attention to the public interest. How, for example, might indirect stakeholders help in an analysis of the public interest?

3. **Policy investigation.** Investigate the "Schedules That Work Act" (H.R.5159 - 113th Congress, 2013-14). (a) Read the act and write a summary, focused on stakeholders, value tensions among stakeholders, and technological elements. (b) Investigate the business community's perspective on this act. (c) Investigate how this act has influenced laws and regulations in States and local communities (e.g., Massachusetts, City of Seattle, etc.)

4. **Technological investigation.** Beginning with the patent by Schwartz, & Desai (2017), investigate the state of the art of workforce management systems. Seek to summarize the capabilities of these systems.

5. **Understanding of time.** Consider how your day to day use of technology, in all its forms, influences your understanding of time. How do you characterize time? How does technology influence your characterization? *Reflecting on the past*—How, if at all, has "work time" encroached upon your "personal time" during your life? How has technology, if subtlety, been implicated? *Speculating on the future*—What might the future hold for your understanding of time? Now consider how various socioeconomic classes might experience time in similar and different ways.

NOTES AND FURTHER READING

Introduction

1. Snyder (2016) offers a fascinating account of time and capitalism, and shows how the patterns of work can impact human experience in subtle and not so subtle ways.

2. O'Neil (2016, chap. 7) discusses the challenge that retail workers experience in their everyday personal lives as they respond to the demands of last minute scheduling.

3. Schreier (2017) notes that the working hours for video game developers can be extreme, leading to increase risks to physical and psychological wellbeing.

4. This advertisement is based on an example given by Snyder (2016, p. 209) and modified slightly.

5. This description of Workforce Management Systems is based on an examination of several patents for such systems, including O'Brien (2003) and Schwartz & Desai, (2017).

6. The statistics on the change in part-time versus full-time workers employed at major retailers comes from Greenhouse (2012).

7. See Kantor (2014) for insight into the challenge of daily life when depending on unstable work schedules.

REFERENCES

DeLauro, R., L. Schedules That Work Act, Pub. L. No. H.R.2942 (2017). Retrieved from https://www.congress.gov/bill/115th-congress/house-bill/2942

Friedman, B., Hendry, D. G., and Borning, A. (2017). A survey of value sensitive design methods. *Foundations and Trends in Human-Computer Interaction*, *11* (23), 63-125.

Greenhouse, S. (2012, October 27). A Part-Time Life, as Hours Shrink and Shift for American Workers - The New York Times. Retrieved November 2, 2017, from http://www.nytimes.com/2012/10/28/business/a-part-time-life-as-hours-shrink-and-shift-for-american-workers.html

Kantor, J. (2014, August 13). Working Anything but 9 to 5 - The New York Times. Retrieved November 2, 2017, from https://www.nytimes.com/interactive/2014/08/13/us/starbucks-workers-scheduling-hours.html

O'Brien, K. (2003). *System and method for online scheduling and shift management*. Google Patents. Retrieved from https://www.google.com/patents/US6587831

O'Neil, C. (2016). *Weapons of Math Destruction*. New York: Broadway Books

Schreier, J. (2017, October 25). Video Games Are Destroying the People Who Make Them - The New York Times. Retrieved November 2, 2017, from https://www.nytimes.com/2017/10/25/opinion/work-culture-video-games-crunch.html

Schwartz, L. S., & Desai, M. D. (2017). *Method and apparatus for real time automated intelligent self-scheduling*. Google Patents. Retrieved from https://www.google.com/patents/US9679265

Snyder, B. H. (2016). *The disrupted workplace : time and the moral order of flexible capitalism*. Oxford ; New York: Oxford University Press.

5

NeighborSpin

SHARING LAUNDRY FACILITIES

Learners are prompted to consider the political, social, and technical aspects of a peer-to-peer sharing economy application. Learners engage a design activity that involves both technical and policy design. The learning aims are to:

1. Introduce some of the political, social and technical aspects of the “Sharing Economy”
2. Develop skills for writing value scenarios while exploring the implications and considerations of policy design and technology implementation
3. Explore the viewpoints of entrepreneurs and policy makers related to innovation, business models, and community-based regulations
4. Explore how policy considerations and human factors can influence technology design and business models.

INTRODUCTION

The Sharing Economy is a term that encompasses communities and businesses that use information technology—social media platforms, dedicated online sites, mobile apps—to facilitate the exchange of goods and services for money, for barter, or for free, within a "gift economy."

Sharing Economy projects range in purpose, stakeholders, and impact. Some projects, such as the Buy Nothing Project (Clark, 2013), are free. Free and small-market exchanges are typically strongly situated in neighborhoods and are intended to foster community and limited commerce. Other projects are global and facilitate perhaps millions of transactions a day. Examples include car services, such as Lyft and Uber, and accommodation rental services, such as AirBnb.

The diversity of interpretations of what constitutes the "sharing economy" has given rise to several alternate terms, including "Collaborative Consumption" (Belk, 2014), the "Gig Economy" (Sundararajan, 2016), the "Peer-to-Peer Sharing Economy," and sometimes, "Goods as a Service" (Botsman & Rogers, 2010). To differentiate them from low or no-cost exchanges and to acknowledge the central profit objective, some commentators refer to the large market exchanges, such as Uber, as "pseudo-sharing" (Belk, 2014). All of these terms and the projects associated with them raise questions about the future of work. For a fundamental critique of the "sharing economy" and potential policy remedies see Calo & Rosenblat (2017).

Ride sharing services. In many U.S. cities, taxi regulation also sets uniform fares and limits the number of authorized taxis to ensure that pricing is transparent for riders and that there is enough business for the drivers and their companies. When the app-powered car services such as Uber and Lyft entered the car service business sector, they operated largely without seeking to meet preexisting regulations for taxis and limousines.

Traditional taxi companies, for example, typically must invest in special taxi licensing (e.g., taxi "medallions"), and are required to charge metered rates set by local government. In addition, they are subject to regulatory scrutiny in many aspects of their businesses. By contrast, Uber and Lyft contract directly with drivers (who use their own cars), charge customers a variable rate based on demand, and conduct all transactions electronically—out of view of regulators (Soper, 2014). Despite the novelty of these arrangements, taxi companies have argued that "ride-hailing" services are, in fact, taxi companies operating outside the law and engaging in unfair competition with the more regulated companies. Adding to the controversy, there have been tragic car accidents and physical assaults on passengers involving ride-

hailing service drivers. However, due to the "contractor" status of the drivers and other quirks of these on-demand business models, the legal responsibilities of the companies and drivers have been unclear and are often contested (Badger, 2013).

Peer-to-peer rentals. Similarly, AirBnb began its operations by enabling potential "hosts" to post room and home rentals on the AirBnb site without concerning themselves with local laws or licensing requirements (Law, 2014). Before long, neighbors were complaining about strangers and noise involving AirBnb rentals (Walker, 2016). Licensed hotels and inns claimed that AirBnb enabled their hosts to engage in unlicensed business operations without having to assume the regulatory burdens or meet the health and safety standards required of traditional establishments. In addition to neighborhood nuisance issues, there have been thefts, assaults, injuries, and even deaths involving AirBnb-brokered accommodations (Lieber, 2015). As with the ride-hailing services, determining liability when things go wrong is not always clear.

Government response. State and local governments have responded to these conundrums and legal ambiguities in many different ways. The City of Portland, Oregon responded to AirBnb and Uber by initially prohibiting their operations outright, but eventually created regulatory schemes that were acceptable to city government. In Seattle, the City Council—to the dismay of ride-hailing companies—has sought to ensure that drivers can unionize if they desire. In France, the Parisian authorities banned a more informal version of Uber, called "UberX," and have challenged the company with aggressive enforcement actions on the streets and in the courts (Alderman, 2015). In Spain, AirBnb received large fines for failing to coordinate their listings with an official tourism board. In Madrid, AirBnb rentals cannot be transacted for fewer than 5 days, leaving the shorter-term market to the hotel industry (Frayer, n.d.). In a sharp contrast, in Reno, NV, AirBnb has been welcomed without complaint by local industry, and mostly ignored by government (Snyder, 2014).

From these examples, we can make several observations.

1. Sharing economy services, enabled by mobile phones, are popular with consumers.

2. Sharing economy services are disruptive businesses, which challenge existing business and economic models and hold very high profit potential. Uber and AirBnb, for example, have been valued at $51 billion and $25 billion, respectively (O'Brien, 2015a, O'Brien, 2015b).

3. Local communities are often unprepared for the introduction of peer-to-peer exchange companies; yet, local politicians and policymakers are often forced to respond quickly when, for example, Uber enters their community. Accordingly, their responses have varied and basic policy questions are far from settled. It seems likely that governments and incumbent businesses will be dealing with new sharing-economy models for the foreseeable future.
4. Technological and legal changes are occurring rapidly in the sharing economy, as businesses innovate and as societies respond to new developments and as new practices and norms develop.

The sharing economy is much more than just AirBnb, Uber, and Lyft. Yet these companies have garnered a large amount of attention in the press and among such stakeholders as local and state governments, taxi/hotel industry groups, business advocates, and concerned citizens. The ensuing controversies illustrate some of the value tensions that have emerged in what was, until recently, a fairly banal marketplace of familiar commercial services and low-impact personal exchanges.

DESIGN ACTIVITY

Design Prompt

Imagine NeighborSpin, a peer-to-peer platform that enables people to share laundry facilities. The idea is that underutilized clothes washers and dryers can be scheduled. Stakeholders get their clothes washed and get to know their neighbors. The root idea is to enable people to more fully utilize a durable good—laundry facilitates.

Is such an idea feasible? If so, in what social context and under conditions? If not, why not?

Design Setting

Explore sociotechnical solutions. Consider several different social contexts—for example, an urban neighborhood, rural community—and explore different technical solutions in those social contexts. Consider your ideas in terms of technical solutions and the social context, and explore these questions:

1. **Social context.** Would some social contexts be more suitable for NeighborSpin than others? What kind of social context might enable NeighborSpin to succeed?
2. **Technical features.** What technical features would need be developed to match people to laundry facilities? How would the technical design features ensure quality standards for the practices of laundry owners and good behavior on the part of the laundry users?
3. **User experience.** What will the user experience be like for the laundry owners and laundry users?
4. **Potential benefits and harms.** What potential benefits and harms might laundry owners and users experience? How, if at all, might the benefits be maximized and harms be minimized?

Design Process

Follow this 5-step design process:

1. **Decide on a root concept.** Based on your explorations of social contexts, technical features, user experiences, and the potential benefits and harms decide on a root concept. The root concept is the central, focusing idea for your version of NeighborSpin.
2. **Identity the direct and indirect stakeholders of NeighborSpin.** Direct stakeholders would interact with the NeighborSpin whereas indirect stakeholders would potentially be impacted by it but would not interact with it. In your analysis also consider non-targeted stakeholders — for example, stakeholders who might want to subvert or abuse the NeighborSpin or somehow engage in fraudulent behavior.
3. **Value source analysis.** Your design is likely to support some values—perhaps, for example, *environmental sustainability*—and depend on others—perhaps, for example, *trust* between neighbors. Identify as many human values as you can that might be implicated by your design. Be sure to consider your own values as designers and the values that your stakeholders might hold.

4. **Develop working definitions of key values.** Of the many values that you have listed, select the three most important values and develop working definitions for them.

5. **Write a value scenario.** Given your stakeholder analysis and your analysis of the potential values implicated by your design, write a 150-word value scenario. A value scenario focuses on stakeholder values, widespread use, indirect impacts, longer-term use, and similar systemic effects. Write a set of bullet points on the most important elements of your value scenario—that is, what are the key things that you are seeking to convey in your value scenario?

Your Presentation

Document the results of your process on a single sheet of poster paper. Cover the following topics:

- **Root concept**
- **Key direct and indirect stakeholders**
- **Key values.**

Introduce your poster and your value scenario in a 5-minute presentation. After your presentation allow for 5-10 minutes for discussing your design solution.

Discussion Questions

1. In what ways do the technical features of your solution to NeighborSpin implicate human values. What human values come into consideration?

2. What values and value tensions are implicated in your value scenario? How will the stakeholders be affected or changed by your design?

3. What are the possible impacts of your design on the community? Will the government get involved? Will business concerns rise up in protest? Will neighbors complain? What might you do about these potential impacts? What are the societal benefits you can tout?

4. Do you see the need for policies to regulate your design solution? Or, relatedly, do you see the opportunity for policies to help create the conditions that will improve the likelihood of success?

5. Reflect on the four-step process for analyzing the technical and social conditions for NeighborSpin. How did the process unfold? What seemed to work? What seemed to be missing?

6. In your value scenario, what time frames did you consider (very soon, a year or two, several years from now, etc.) ? How do you think the time frame influenced your value scenario?

7. Do you think your solution to NeighborSpin is *feasible* from an business standpoint? Do you think that people would invest in your idea? Why or why not?

INSTRUCTOR NOTES

This case study has been successfully adapted for use in a 50-minute classroom session, comprising mostly first and second year undergraduates in Informatics. In addition, it has also been used in a 10-15 hour project, spanning two in-class studio sessions, and worth 15% of the overall grade in an advanced undergraduate Informatics class.

In a 110-minute undergraduate class, the activity might be structured as follows:

1. Read the section "Sharing Economies and Other Economies" (10 min)
2. Working in groups of three or four, explore the design prompt and follow the design process (45 min)
3. Develop and write the value scenario (20 min)
4. Presentations and consider the discussion questions (35 min).

REFLECTIVE WRITING PROMPTS AND EXERCISES

1. Typically, different stakeholders value different things. Furthermore, sometimes a single stakeholder may be uncertain or conflicted about the importance of a value or set of values. In these cases, *value tensions* can arise. Beginning with your value stakeholder analysis (step #2) and value analysis (step #3 and #4), identify and discuss two key value tensions of your design solution.
2. Write a 500-word reflective statement on your process, focused on how your policy and technical design explorations worked together and how they played out in your value scenarios.

3. In this design activity, you pursued a four-step process. Propose a 10-15 hour feasibility study that builds on this short design activity. How might you develop and elaborate the methods that you employed? What new methods would go into your study?

4. Is your design solution feasible? Prepare a three-page report that supports your view and makes a recommendation for either moving the project forward or not.

ALTERNATIVE DESIGN PROMPT

Suppose you are the mayor of a mountain town that relies on seasonal tourism as a major economic driver. There are a handful of locally-owned hotels and inns that are well-established, but business is up and down. One business recently failed. You have learned that several townspeople have started advertising rooms for rent in private homes through the "home-sharing" service, AirBnb.

AirBnb rentals tend to be cheaper than accommodations at the established businesses. All transactions take place online, so it's not clear how much business is taking place, but the management of the incumbent hotels and inns report that they are losing revenue. AirBnb has not contacted local authorities to seek permission, and they have not offered to pay any fees or taxes.

Opinions among townspeople are mixed. Some think AirBnb will provide needed income to renters. Others, including the owners of local hotels and inns, argue that the competition is unfair, and that quality standards can't be assured at the AirBnb rentals, potentially creating problems for visitors. The town council is looking to you to lead the way in deciding how to proceed. Consider all of the potential benefits for the townspeople, as well as the "disruption" that might occur in the business environment and economy. Propose some possible approaches that will provide the best outcomes, taking into account the interests of the direct and indirect stakeholders. If the town decides to regulate home-sharing, you'll have to figure out how to enforce whatever rules are put in place and monitor the transactions.

1. **Policy Design.** What sort of home-sharing regulations make sense for your town?
   - Prohibit AirBnb (and the like)?
   - Do nothing and let the market work it out?
   - Regulate home sharing?
   - If new policies are put in place, how will they be enforced?

2. **Technical Design.** How might new/repurposed technology play a role? Can you think of a technical artifact that could support the interests of the businesses? How about one that would provide transparency in regulating home-sharing?

3. **Write a value scenario.** Develop a narrative that incorporates your design solutions. Imagine stakeholders interacting with your policy and technical solution. What would happen next? Consider the short, medium and long term effects. Consider how your approach, if it became the 'norm' for other towns, would impact other stakeholders. Think about consequences, including unexpected ones.

REFERENCES

Alderman, L. (2015, June 3). Uber's French Resistance. *The New York Times*. Retrieved from http://www.nytimes.com/2015/06/07/magazine/ubers-french-resistance.html

Badger, E. (2013, September 10). The Strange Tale of an Uber Car Crash and What It Means for the Future of Auto Insurance. Retrieved September 2, 2015, from https://www.bloomberg.com/news/articles/2013-09-10/the-strange-tale-of-an-uber-car-crash-and-what-it-means-for-the-future-of-auto-insurance

Belk, R. (2014). You are what you can access: Sharing and collaborative consumption online. *Journal of Business Research*, *67*(8), 1595–1600. http://doi.org/10.1016/j.jbusres.2013.10.001

Botsman, R., & Rogers, R. (2010). Beyond Zipcar: Collaborative Consumption. *Harvard Business Review*, *88*(10), 30–30.

Calo, R. and Rosenblat, A. (2017). The taking economy: Uber, information, and Power. *Columbia Law Review*, *117*, 68 pages. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2929643

Clark, L. (2013). Buy Nothing Project. Retrieved March 10, 2016, from http://buynothingproject.org/blog-2/

Frayer, L. (n.d.). Uber, Airbnb Under Attack In Spain As Old And New Economies Clash. Retrieved March 2, 2016, from http://www.npr.org/sections/parallels/2014/07/29/327796899/uber-airbnb-under-attack-in-spain-as-old-and-new-economy-clash

Law, S. (2014, June 24). Portland to embrace Airbnb-type short-term rentals but not in apartments and condos. Retrieved September 1, 2015, from http://portlandtribune.com/pt/9-news/225147-87529-portland-to-embrace-airbnb-type-short-term-rentals-but-not-in-apartments-and-condos

Lieber, R. (2015, November 13). Death in Airbnb Rental Raises Liability Questions. The New York Times. Retrieved from http://www.nytimes.com/2015/11/14/your-money/death-in-airbnb-rental-raises-liability-questions.html

O'Brien, S. A. (2015a, June 27). "Crazy money" - Airbnb valued at over $25 billion. Retrieved February 19, 2016, from http://money.cnn.com/2015/06/27/technology/airbnb-funding-valuation-update/index.html

O'Brien, S. A. (2015b, July 31). Uber is the most valuable startup in the world. Retrieved February 20, 2016, from http://money.cnn.com/2015/07/31/technology/uber-50-billion-valuation/index.html

Snyder, R. (2014, June 5). Despite national concerns, Airbnb welcome in Reno. *Reno Gazette Journal*. Retrieved from http://www.rgj.com/story/news/2014/05/19/despite-national-concerns-airbnb-welcome-reno/9269343/

Soper, T. (2014, December 8). Portland files lawsuit against Uber, asks company to stop operating illegally. Retrieved from http://www.geekwire.com/2014/portland-files-lawsuit-uber-asks-company-stop-operating-illegally/

Sundararajan, A. (2016). *The Sharing Economy: The End of Employment and the Rise of Crowd-based Capitalism*. MIT Press, Cambridge, MA.

Walker, R. (2016, March 5). Airbnb Pits Neighbor Against Neighbor in Tourist-Friendly New Orleans. The New York Times. Retrieved from http://www.nytimes.com/2016/03/06/business/airbnb-pits-neighbor-against-neighbor-in-tourist-friendly-new-orleans.html

6

Internet of Things

GASLIGHTING AND THE SMART HOME

Learners consider the features of a "Smart Home" and explore a worst-case scenario, namely, that a smart home might be used in a gaslighting attack. Gaslighting is a term, first introduced in 1969 by British psychiatrists, to refer to situations where one person seeks to induce mental illness in another person by subtle and subversive changes to the target's environment — for example, the lighting in one's home. Learners are positioned to design policy and technical solutions.

INTRODUCTION

Please Note: This scenario contains potentially distressing content related to domestic abuse.

The "Internet of Things" is poised to shape societies for years to come. The vision is for physical objects, of all kinds in all places, to dynamically and intelligently respond to human needs and circumstances. Manufacturers and tech optimists promise more efficiency and happiness. The *New York Times* puts it this way:

> Cars, door locks, contact lenses, clothes, toasters, refrigerators, industrial robots, fish tanks, sex toys, light bulbs, toothbrushes, motorcycle helmets — these and other everyday objects are all on the menu for getting "smart." Hundreds of small start-ups are taking part in this trend — known by the marketing catchphrase "the internet of things" — but like everything else in tech, the movement is led by giants, among them Amazon, Apple and Samsung.

The constellation of technologies that make up the Internet of Things will, in all likelihood, create benefits and lead to new social and economic opportunities. On the other hand, just as likely, the Internet of Things will also enable inappropriate or unsafe behaviors, create challenges and unintended consequences, and lead to harms.

According to Melvin Kranzberg, a philosopher of technology, any "technology is neither good nor bad; nor is it neutral." Accordingly, the Internet of Things will surely be empowering and problematic at the same time, a double-edged sword. How empowering? How problematic? And, for whom? While somewhat difficult to predict, the social and economic impacts of this foundational technology, experienced directly and as ripple effects, are likely to be very substantial. At least the following values are at stake: privacy, security, control, and freedom.

Leading technologists, Francine Berman and Vinton Cerf, write: "The difference between an IoT [Internet of Things] that enhances society and one that diminishes it will be determined by our ability to create an effective model for IoT governance" (Berman & Cerf, 2017). One approach for discovering what a model of governance needs to address is to explore worse-case scenarios—that is, what might go wrong and what might be done so that big problems are less likely to occur.

Stepping back, the Internet of Things can be viewed as a network of objects and devices that sense, compute, exchange information, and respond. With some engineering, anything that has an on-off switch might plausibly become part of the Internet of Things. By 2020, it is expected that more than 30 billion things will be

connected to the Internet. More impressive still, the Internet of Things is a unifying technology because a smart object might be located anywhere: in cyberspace, in the built environment, and in biological systems. Even ordinary things such as paint, food, and, indeed, any material, might be made smart in the future.

The "Smart City," for example, refers to a vision of greater efficiency, safety, and less environmental impact. Sensors embedded in roads might monitor traffic volumes and dynamically adjust highway tolls, optimizing traffic flows, based on the willingness of people to pay for fast travel times. Safety cameras, mounted on traffic lights, might be used to enforce the rules of the road. Automatic license plate readers might identify drivers, or at least cars, who are speeding or running red lights. On-board sensors in buses might monitor locations and expected arrival times at bus stops and send updates to mobile phones. This technology, however, might collect and store data on the movement of people which, in turn, might be useful for identifying welfare fraud and other crimes. In so doing it might also violate individual privacy. In the Smart City many different data streams might be brought together to offer an overall model of the city and reveal patterns of where groups and individuals go.

The "Smart Store," such as Amazon Go, eliminates check-out lines. Enter the store, identify yourself by scanning a mobile phone at a turnstile, shop as you normally would, and just leave the store—there you go: no lines, a more efficient shopping experience, and individual empowerment. Perhaps facial recognition technology or ID chips embedded in customers' bodies will do away with the need to explicitly authenticate with a phone. It has been reported that Amazon is going to open 3,000 such stores by 2021, targeting neighborhoods of affluent, young urbanites. People with low incomes, those who decide against owning a mobile phone, or those who object to using a phone to authenticate in public spaces, are unlikely to use Smart Stores. Similarly, cars might be equipped with communication capabilities for purchasing products and services. While out and about, order your favorite coffee drink, pick it up at the nearest drive-thru, and use your shopping cart to pay for it—easier, more efficient transactions, and perhaps more control on how one's time is spent.

The "Smart Home" promises greater control, efficiency, and safety, for new and better human experiences at home. In the Smart Home, lightbulbs, doorbells, furnaces, lights, air conditioners, coffee pots, and locks will be controlled from a mobile phone. Offering pleasure and efficiency, smart speakers, which translate the human voice and language into commands for the Internet of Things, might become the control center of homes. But, such speakers, unbeknownst to people at home, might also be able to identify highly personal things such as indicators of mental illness. Toys and vacuum cleaners, connected to the Internet, might respond to human commands and home conditions. Hidden cameras, sometimes called "nanny cams," might be used

to monitor the front door or the baby's room. Other home cameras, installed in the living room and kitchen, might be used by adult children to keep in touch with their elderly parents. Sensors in the floors might identify when an elder falls or whether their balance is deteriorating or improving after, for example, a hip replacement. The same sensors might also learn to identify people by their gait and detect familiar and first-time visitors. Smart meters measuring electricity and water consumption might enable homeowners to save money and reduce their home's environmental impact. However, should a third-party gain access to time-series data of electricity and water consumption a good deal might be inferable, for example, television watching, cooking, and showering habits.

The "Smart Body," might contain sensors that measure vital indicators of health, enabling people to set goals, measure progress, and keep medical personnel appraised. Such data might restructure the doctor-patient relationship and make it more patient-centered. With granular analysis of sensor data in combination with atmospheric data—temperature, pollen counts, measures of particulate concentrations—new discoveries in health care might be made. At the same time, life insurance companies might use this data to dynamically adjust their rates. In a different vein, police departments might use data about individuals—their location, sleeping patterns, and physiological measures—to help solve crimes.

The Internet of Things on a "Smart Farm" might signal such information as: it's time to irrigate the corn (because a sensor indicates that the soil is dry), it rained 5 mm yesterday, a predator threatens the herd of cattle (because the heard is sending a collective signal of anxiety), the feed stock is low, the cold storage room is up to 3 Celsius, someone is in the barn, the gate was left open.

In wild places, the "Smart Ecosystem," might be designed to include sensors and cameras, strategically placed in the woods, for investigating the movements of wildlife. When chips are embedded in wolves and livestock, for example, wildlife managers might monitor their travels and, like a video game, zap them with an electric shock to keep them separated. Perhaps, via their mobile phones, hikers will be informed of the presence of a nearby grizzly bear. But, what of hunters: Should they be informed? Might hunters pretend to be hikers? Not plausible? Perhaps. But, with the Internet of things, if it can be imagined, it might be possible.

As these examples show, the opportunities to deploy the Internet of Things appear to be boundless, limited only by our technical imagination for new human experiences. Yet, in these examples, we can also discern the double-edged sword of this technology, where features and capabilities might produce benefits, along with harms and potentially distressing consequences.

One stunning example of a harm occurred on October 21, 2016 when the Internet of Things was exploited to execute a distributed denial of service attack, the so-called "2016 Dyn cyberattack." It is believed that the attackers constructed a botnet by infecting residential printers, cameras, baby monitors, and so forth with malware. That malware was used to flood an Internet domain name service with so many requests that legitimate requests could not be served, leading to major websites being unavailable. The root cause of the attack was poor security of ordinary residential objects that were connected to the Internet. In another example, in May 25, 2018 the FBI issued a public service announcement, requesting all owners of small office and home routers to reboot them. Bad actors had introduced malware that could be used to exploit routers and to capture information and render them inoperative.

DESIGN ACTIVITY

Design Setting

Envision a smart home filled with Internet-connected objects that can be used to monitor and control the home. Furthermore, imagine that Cory and Riley, once married, have separated, because of Cory's controlling and abusive behavior.

Riley continues to live in the home they once shared.

Cory set-up the Internet of Things at home, knows the passwords, and has deep knowledge for the home network and connected devices. Riley, however, has limited knowledge for how the technology is set-up.

Cory has started to treat Riley cruelly by utilizing the features of their Smart Home. Cory can flicker the lights, adjust the thermostat, ring the doorbell when no one is there, and other manipulations to Riley's home environment.

Seeking to psychological harm someone by controlling an environment through subtle, often creative and subversive, forms of manipulation is sometimes called "gaslighting." The goal of the abuser is to make the victim question his or her memory, perception, and understanding. First described by British psychiatrists in 1969, the term gaslighting comes from a stage play, *Gaslight*, where a husband surreptitiously manipulates small elements at home, including the gas lamps, seeking to convince his wife that she is insane.

In modern days, Cory is using Internet of Things technology in the home to gaslight Riley, making Riley feel unsafe and unsure about what is real.

Design Prompt

Consider the Internet of Things in the context of an affluent home, that is, a home where its occupants have sufficient discretionary income to purchase the latest Internet-ready devices. Take a worse-case scenario perspective and investigate how the home might be used as a tool for gaslighting. How might attempts for control and psychological manipulation be resisted or prevented?

Design Process

To engage the design prompt, follow this suggested process:

1. **Explore technical features.** Explore the technical features of the home. What devices are connected to the Internet? How are they controlled and interconnected? How might the home's devices send subtle and not so subtle signals into the living spaces? To capture and represent your ideas, draw a sketch that presents the devices and their physical and digital interconnections.

2. **Write a value scenario.** Write a 200-word value scenario in which Cory employs features of their smart home in a gaslighting attack, that is, to try to psychologically manipulate Riley. How might Riley be an *indirect stakeholder*? How is Cory a *direct stakeholder*? (Note: A *direct stakeholde*r directly interacts with a technology whereas an *indirect stakeholder* is impacted by a technology but does not directly interact with it.) Give your value scenario a short and compelling title. With a set of 3-5 bullet points, note the key features of your value scenario.

3. **Explore remedies, technical requirements, and regulations.** Given the value scenario, step back and consider what technical features and regulations might be developed so Internet-connected devices in the smart home are less likely to be used in gaslighting attacks. Outline 2-3 technical requirements and 2-3 policy guidelines that might enable.

Your Presentation

Document the results of your process on a single sheet of poster paper.
Cover the following topics:

- **Technical features and their connections**
- **Key direct and indirect stakeholders**
- **2-3 technical requirements and 2-3 policy guidelines**

Introduce your poster and your value scenario in a 5-minute presentation.
After your presentation allow for 5-10 minutes for discussing your design solution.

Discussion questions

Consider the following discussion questions:

1. How, if at all, does your value scenario show that regulations of smart home technologies are necessary?
2. How do your proposed technical requirements for a smart home relate to your proposed regulations? Are they each in their own separate spheres or do they intersect?
3. What responsibilities do software and hardware engineers have for ensuring that smart home technology is not used for harm? What possible actions might an engineer take if she identifies a feature in a device that might be exploited by an attacker? See Tarnoff (2018) for some noteworthy examples where employees have resisted management.

REFLECTIVE WRITING PROMPTS AND EXERCISES

1. Do you agree with the claim that: "The difference between an IoT [Internet of Things] that enhances society and one that diminishes it will be determined by our ability to create an effective model for IoT governance" (Berman & Cerf, 2017)? Please discuss.
2. Suppose the parents of an adolescent suspect that she is experimenting with drugs. How might the Internet of Things be used as a tool for investigating this possibility and for controlling the behavior of the adolescent? Would this use of smart technology be appropriate? What might be gained? What might be lost?
3. Discuss how this applies to the Internet of Things: "technology is neither good nor bad; nor is it neutral."

NOTES AND FURTHER READING

Introduction

1. The *New York Times* quotation comes from Manjoo (2018).
2. For an introduction to the Internet of Things see FTC Staff Report (2015).
3. For a short discussion of the possible benefits of IT Governance, see Berman & Cerf (2017).
4. The number of expected objects in the Internet of Things comes from Statista (n.d.).
5. Stenquist (2018) describes cars with communication functions that simplify purchasing things and services, saving people time.
6. Data collected from automatic license plate readers have been used to identify welfare fraud and for other such purposes but at the cost of individual privacy and perhaps in ways that violate law (Maass, 2018; Fussel, 2018).
7. Soper (2018) provides a brief introduction to Amazon Go. See also González (2016).
8. The reported number of new Amazon Go stores comes from Super (2018).
9. On the use of facial recognition technology to improve efficiency in lines, see Alan (2018).
10. Cook (2018) reports on a patent awarded to Amazon that identifies illness based on the qualities and affect of a speaker's voice.
11. Hauser, C. (2018) reports on the police using Fitbit data as evidence for identifying and charging a murderer.
12. The questions that might be answered at a "Smart Farm" comes from Sigfox. (n.d.).
13. For IBM's public service announcement related to home routers, see FBI (2018).
14. For more on the 2016 Dyn Cyberattack, see 2016 Dyn Cyberattack - Wikipedia (n.d.).
15. For more on Internet of Things botnet threats, see Weagle (2018).

Design Setting

1. The New York Times reports that smart homes are being used in domestic abuse cases (Bowles, 2018).
2. Gaslighting was first described by Barton & Whitehead (1969). See also Cawthra, O'Brien, & Hassanyeh (1987).

REFERENCES

2016 Dyn cyberattack - Wikipedia. (n.d.). Retrieved October 7, 2018, from https://en.wikipedia.org/wiki/2016_Dyn_cyberattack

FTC Staff Report (2015). *Internet of Things: Privacy & Security in a Connected World*. Retrieved October 16, 2018, from https://www.ftc.gov/system/files/documents/reports/federal-trade-commission-staff-report-november-2013-workshop-entitled-internet-things-privacy/150127iotrpt.pdf

Alan, L. (2018, October 15). TSA bringing facial recognition to airport security lanes | The Seattle Times. Retrieved October 16, 2018, from https://www.seattletimes.com/business/tsa-bringing-facial-recognition-to-airport-security-lanes/

Barton, R., & Whitehead, J. A. (1969). The Gas-Light Phenomenon. *The Lancet*, *1*, 1258–1266.

Berman, F. And Cerf, V. G. (2017). Social and ethical behavior in the Internet of Things. *Communications of the ACM*, *60*(2), 6-7.

Bowles, N. (2018, June 23). Thermostats, Locks and Lights: Digital Tools of Domestic Abuse - The New York Times. Retrieved October 17, 2018, from https://www.nytimes.com/2018/06/23/technology/smart-home-devices-domestic-abuse.html

Cawthra, R., O'Brien, G., & Hassanyeh, F. (1987). 'Imposed Psychosis': A Case Variant of the Gaslight Phenomenon. *British Journal of Psychiatry*, *150*(4), 553-556. http://doi.org/10.1192/bjp.150.4.553

Cook, J. (2018, October 9). Amazon patents new Alexa feature that knows when you're ill and offers you medicine. Retrieved October 12, 2018, from https://www.telegraph.co.uk/technology/2018/10/09/amazon-patents-new-alexa-feature-knows-offers-medicine/

FBI. (2018, May 25). Internet Crime Complaint Center (IC3) | Foreign Cyber Actors Target Home and Office Routers and Networked Devices Worldwide [Public Service Announcement]. Retrieved October 11, 2018, from https://www.ic3.gov/media/2018/180525.aspx

Fussel, S. (2018, October 16). In Fraud Detection, Everything You Do Online and Off Is a Clue. *The Atlantic*. Retrieved from https://www.theatlantic.com/technology/archive/2018/10/online-fraud-detection-surveillance/573175/

González, Á. (2016, December 5). Amazon unveils smart convenience store sans checkouts, cashiers | The Seattle Times. Retrieved from https://www.seattletimes.com/business/amazon/amazoncom-unveils-self-driving-brick-and-mortar-convenience-store/

Hauser, C. (2018, October 3). Police Use Fitbit Data to Charge 90-Year-Old Man in Stepdaughter's Killing - The New York Times. Retrieved October 7, 2018, from https://www.nytimes.com/2018/10/03/us/fitbit-murder-arrest.html

Kranzberg, M. (1986). Kranzberg's laws. *Technology and Culture*, *27*, 544-560.

Maass, D. (2018, July 31). County Welfare Office Violated Accountability Rules While Surveilling Benefits Recipients | Electronic Frontier Foundation. Retrieved October 17, 2018, from https://www.eff.org/deeplinks/2018/07/county-welfare-office-violated-accountability-rules-while-surveilling-benefits

Manjoo, F. (2018, October 10). A Future Where Everything Becomes a Computer Is as Creepy as You Feared - The New York Times. Retrieved October 11, 2018, from https://www.nytimes.com/2018/10/10/technology/future-internet-of-things.html

Sigfox. (n.d.). Retrieved October 17, 2018, from https://www.sigfox.com/en/agriculture

Soper, S. (2018, September 19). Amazon Said to Plan Up to 3,000 Cashierless Stores by 2021 - Bloomberg. Retrieved October 7, 2018, from https://www.bloomberg.com/news/articles/2018-09-19/amazon-is-said-to-plan-up-to-3-000-cashierless-stores-by-2021

Statista. (n.d.). IoT: number of connected devices worldwide 2012-2025. Retrieved October 4, 2018, from https://www.statista.com/statistics/471264/iot-number-of-connected-devices-worldwide/

Stenquist, P. (2018, October 14). Order a coffee and pay, with a tap on your car's dash | The Seattle Times. Retrieved October 16, 2018, from https://www.seattletimes.com/business/order-a-coffee-and-pay-with-a-tap-on-your-cars-dash/

Tarnoff, B. (2018, August 9). Can Silicon Valley workers rein in Big Tech from within? | Ben Tarnoff | Opinion | The Guardian. Retrieved October 15, 2018, from https://www.theguardian.com/commentisfree/2018/aug/09/silicon-valley-tech-workers-labor-activism

Weagle, S. (2018, January 30). The Rise of IoT Botnet Threat and DDoS attacks | Corero. Retrieved October 17, 2018, from https://www.corero.com/blog/870-the-rise-of-iot-botnet-threats-and-ddos-attacks.html

GLOSSARY

The case studies refer to technical terms from law, policy, and design, especially value sensitive design (Friedman & Hendry, 2019; Friedman, Hendry, & Borning, 2017).

The acronym VSD refers to "value sensitive design."

Direct and indirect stakeholder analysis *(VSD method).* Identification of individuals, groups, organizations, institutions, and societies that might reasonably be affected by the technology under investigation and in what ways. Two overarching stakeholder categories: (1) those who interact directly with the technology, direct stakeholders; and (2) those indirectly affected by the technology, indirect stakeholders.

Human dignity *(human value).* A foundational value where people are inherently respected and valued and able to live a full life. The human capabilities approach offers a conceptual framework for investigating the elements of human dignity (Nussbaum, 2006).

Machine learning *(technical approach).* Field of study where computers are programmed to write their own algorithms, often relying on massive data sets (Domingos, 2015).

Predictive analytics *(technical approach).* Using computational approaches, often machine learning techniques, to predict future events.

Public interest *(legal concept).* Laws, regulations, and policies that are designed to improve the well-being of people who live in a society.

Stakeholder, direct *(VSD theoretical construct).* An individual or group who interacts directly with a technology. For example, a system of electronic medical records might be designed for doctors and insurance companies. See *stakeholder, indirect*.

Stakeholder, indirect *(VSD theoretical construct).* An individual or group who is impacted by a technology but does not directly interact with it. For example, some systems of electronic medical records are not intended to be used by patients but, quite obviously, the use of an electronic medical record by doctors, insurance agencies will impact patients. When a small drone flies over a bystander, she may be bother by its sound and presence and her privacy might be violated. The bystander would be an indirect stakeholder. In contrast, the operator of the drone would be a direct stakeholder.

Value *(VSD theoretical construct).* What is important to people in their lives, with a focus on ethics and morality.

Value Scenario *(VSD method).* A written narrative, or story, that concretely describes a situation involving human values and technology. Value scenarios focus on the human-technology relationship, typically through these elements: stakeholders, values, time, and pervasiveness. Values scenarios can be short and quite focused (around 50 words) or longer and more expansive (more than 600 words).

Value tension (*VSD theoretical construct*). When one or more values come to be compared, sometimes the comparison leads to a value tension. For example, an adolescent might seek fun experiences that are safe; here, the values of *fun* and *safety* might be in tension. This tension may arise between stakeholders (the adolescent and the parents) or within an individual (the adolescent with herself). In information systems, a classic value tension is between *access* and *security*. To keep information secure, one can reduce access. Value tensions can be addressed in a variety of ways, for example, by some kind of cost-benefit analysis, by the value dams and flows VSD method, by designing solutions that somehow resolve the tension, or even through dialog and social agreements, where the value tension is accepted as being unresolved.

REFERENCES

Domingos, P. (2015). *The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our Work*. New York, NY: Basic Books.

Friedman, B., Hendry, D. G., & Borning, A. (2017). A survey of value sensitive design methods. *Foundations and Trends in Human-Computer Interaction*, *11* (23), 63–125. http://doi.org/10.1561/1100000015

Friedman, B., & Hendry, D. G. (2019). *Value Sensitive Design: Shaping Technology with Moral Imagination*. Cambridge, MA: MIT Press.

Nussbaum, M. (2006). *Frontiers of Justice: Disability, Nationality, and Species Membership*. Cambridge, MA: Belknap Press.

ABOUT THE INSTRUCTIONAL CASE STUDIES

The UW Tech Policy Instructional Case Studies position students to consider the deeply interactional processes of human values and technology. Within pedagogical bounds, students engage both technical and policy elements and develop design solutions. For instructors, the instructional case studies have been written so that they can be revised and re-used for varied educational settings.

Over a thousand students have engaged with the case studies. They have been used with educational and industrial partners, in the US and International settings, from small workshops with senior designers and policymakers, to advanced graduate seminars, to graduate and undergraduate design studio classes, to 200-person introductory undergraduate classes, to STEM workshops for middle school students.

The case studies:


"Drones Okay" Playground: Fun with Personal Drones


Internet of Things: Gaslighting and the Smart Home


NeighborSpin: Sharing Laundry Facilities


Workforce Management: Scheduling Call-Center Workers.

How to Contact Us

Please share your experiences with the case studies,
and we welcome your questions and comments.
Please email us at: info@techpolicylab.org