Timelines: Design Activities for Surfacing Social Values and Ethics in Technology

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Contents

Executive Summary

This report presents *Timelines*, an activity designed to help groups explore social values and ethical issues related to a given technology. Developers and designers of new technologies have an ongoing need for accessible, research-based methods to help them anticipate and unearth potential consequences of the tools they are designing. While many such evaluation methods exist within academic or research contexts, their use outside of these contexts has been limited. We offer this report to help bridge this gap, and include a facilitation guide for teams or educators to complete the *Timelines* activity within their own organizations.

In *Timelines*, participants generate news headlines to develop a "storyworld," a hypothetical future in which the technology exists. They then create social media posts as they might be written by various stakeholders with diverse perspectives on the new technology. By encouraging participants to think at both macro- and micro-levels, *Timelines* helps participants assess potential impacts at a broad scale while also considering the diversity of impacts a single technology can have. Specifically, *Timelines* was designed to help participants meet four goals:

- Recognize how social values are experienced from different points of view;
- Identify how direct and indirect stakeholders may be affected by a technology;
- Create a rich fictional world in an easy and accessible way; and
- Think about broader social effects related to new technologies.

Timelines requires relatively few materials and can be facilitated in a variety of in-person and virtual settings, including classrooms, interactive workshops, and industry settings. *Timelines* can help educate students and practitioners to consider potential harms and risks related to technologies before they are created and widely deployed, and it provides scaffolding for researchers, practitioners, and decision-makers to anticipate unintended consequences that may result from a new technology.

All new digital technologies have the potential to result in unintended harmful consequences, such as data breaches, online abuse, and algorithmic bias and exclusion. *Timelines* helps ensure that organizations are not caught off guard by these negative impacts after a new technology has already been deployed and adopted. Using *Timelines* and similar tools can help organizations identify changes that need to be made to a technology's design or use policies before key decisions are finalized — and before real-world harms can occur.

Introduction

As novel technologies are adopted in different aspects of everyday life, they are often accompanied by questions about social values, ethics, and human rights. For instance, researchers and users have raised concerns about algorithmic bias[1] (when computer programs make discriminatory decisions based on race, gender, or other factors), as well as new forms of surveillance, such as people's fitness tracker data being shared with employers, or law enforcement's ability to capture and share smart doorbell camera video footage indefinitely, even without evidence of a crime.[2] These concerns have motivated the development of a variety of tools, methods, and frameworks to address ethical issues related to technology development and use.[3] Creative tools like card decks with customized questions and prompts have shown promise as a methodology to help technology designers brainstorm and ask questions about social values and ethics during the design process.[4]

Nevertheless, there is still a desire among educators, researchers, and practitioners to explore technology-related values with tools grounded in *specific contexts of use*, which can lead to more actionable interventions and outcomes.[5] A structured process for creatively imagining the future is particularly helpful, as it can be difficult for technology designers to imagine what possible risks and harms might occur in the future.

This report presents *Timelines,*[6] an accessible design activity that helps participants surface discussion about values and ethical issues related to a technology of their choosing. The report also provides a facilitation guide for teams or educators to complete the *Timelines* activity within their own organizations. In *Timelines,* participants first create news headlines to develop a "storyworld," a hypothetical future in which the technology exists. They then create social media posts from various stakeholders to illuminate diverse perspectives on the new technology. By encouraging participants to think at both macro- and micro-levels, *Timelines* helps participants connect broad societal changes with the diversity of impacts a single technology can have.

Timelines can be facilitated in a variety of in-person and virtual settings, including classrooms, interactive workshops, and industry settings. *Timelines* can help educate students and practitioners to weigh the potential harms and risks related to technologies before they are created and widely deployed, and it provides scaffolding for researchers, practitioners, and decision-makers to generate foresight about the potential unintended consequences resulting from decisions they make when designing a new technology.

Background: Design Interventions in Relation to Values and Ethics

The *Timelines* design activity is motivated by two insights. The first is that social values are "essentially contested,"[7] i.e., they are multi-definitional, open for debate, and variable across contexts. For instance, there is no single definition of privacy, security, fairness, or explainability that will work all the time and in every situation. This leads to the second point: we need tools, interventions, and approaches that can help spark conversation and debate to understand what a value like privacy or security means in a certain context or situation (or sometimes, how multiple meanings of those social values might be at play).

Often we think about design as a process to solve problems, which is a deductive or top-down approach. This process starts from a set of agreed-upon requirements and principles, which logically leads to a solution that meets those requirements.[8] While deductive tools like checklists and impact assessments are useful, particularly during compliance-oriented processes, such approaches tend to assume that an issue related to values or ethics has been well-defined in advance. As a result, such approaches can miss out on problems that do not neatly fit that definition.

To address the fuller range of ethical issues at play in emerging technologies, we need to complement tools like impact assessments with bottom-up and inductive tools that are based on a more open-ended process. This includes activities like holding workshops where a diverse range of participants brainstorm design ideas, a process that can help bring to light people's beliefs, desires, needs, or concerns. The goal of such activities is less about finding design ideas to prototype and develop into products than it is about understanding people's priorities and perspectives based on the types of ideas they propose. Another approach is to generate "what if" scenarios about a technology, as this can help foster debate and clarify definitions about whatever value or ethical issue a designer is grappling with.

Timelines is a structured design activity that provides a bottom-up and inductive approach that enlists people in creating "what if?" scenarios in order to identify and discuss potential harms and risks related to a technology. (For more about how this activity was developed, see the box, "Developing *Timelines*.")

BACKGROUND: DEVELOPING *TIMELINES*

Timelines was developed by Richmond Wong and Tonya Nguyen, researchers at the University of California, Berkeley School of Information. Using an iterative design process, we facilitated the activity with groups in a variety of settings in order to see what types of approaches would best help participants discuss and reflect on values and ethical issues related to technology. During development and since being published,[9] *Timelines* has been facilitated:

- As an educational activity in undergraduate and graduate courses in information science and communications departments;
- At multiple academic conference workshops focused on thinking about privacy or ethics in emerging technologies;
- With members of an interdisciplinary university research lab studying sensing technologies, to help them reflect on the implications of their research;
- With students in an information technology master-degree program, to understand how the activity helps them surface and discuss values issues.

Participants have discussed how the activity is enjoyable and helps them think about issues they have not previously considered. One participant from these sessions noted:

I've done some scenario thinking activities before, but I feel a bit boxed in by its "coming up with two independent axes" approach. I also think scenarios highlight the "surround," but don't do as much to highlight individual consequences of technologies. So Timelines solves those two problems for me, and I also find it fun to do!

CASE STUDY: MISSING THE FULL PICTURE

In 2007, the Transportation Security Administration (TSA) began using airport security body scanners that relied upon backscatter and millimeter wave technology. These new scanners improved TSA agents' ability to detect foreign objects, but they also captured detailed outlines and images of passengers' bodies, which critics argued were effectively nude images.[10] Many felt that these images were a privacy violation, and eventually the displays were changed to show a generic body with highlighted areas, instead of images of an individual's specific body.[11]

Before they were deployed, these machines had gone through a privacy impact assessment process, a widely used deductive values and ethics tool.[12] So why was the seemingly obvious "nude image" issue not identified as a potential privacy concern?

The privacy impact assessment defined "privacy" as relating to the collection and processing of personally identifiable information. In line with that definition, the machines blurred out (identifiable) faces, did not store the images, and did not connect the images to passenger data. Because they did not collect any personally identifiable information, the new scanners were not seen as presenting any serious privacy problems.

This example highlights how a predetermined process, such as a privacy impact assessment, can miss the full picture and lead to decisions based on the wrong definition of privacy. People's privacy concerns in this case were not about sharing personally identifiable information, but rather about their personal dignity and discomfort with strangers seeing their naked bodies. Perhaps a more inductive, or open-ended approach that tried to surface multiple conceptions of privacy might have flagged this privacy issue earlier.

Overview of the Timelines Activity

Timelines is an accessible, low-barrier-to-entry design activity that facilitators can use to help participants think about technologies, social values, and ethics. The activity helps participants surface discussion about broad, societal-level changes related to a technology by creating stories from news headlines, and it helps them recognize a diversity of experiences by leading them to create social media posts from different individuals' viewpoints.

Timelines Steps Overview

- **Step 1**: As a group, decide on an "artifact," a technology, system, or feature that you want to explore.

- **Step 2**: On index cards, brainstorm a list of stakeholders, individuals or groups who may be related to the artifact, either directly or indirectly.

- **Step 3**: Using sticky notes, individually brainstorm potential news headlines related to the artifact.

- **Step 4**: Take turns placing the headlines on the large shared timeline triangle to create timelines of events related to the technology.

- **Step 5**: Return to the stakeholder index cards from Step 2. Brainstorm possible social media posts as they would be written from the perspectives of different stakeholders.

- **Step 6**: Share your social media posts with the other participants, and shift into a broader discussion to reflect on insights from the activity.

While there are no specific requirements for facilitators of *Timelines*, ideally the leaders of a session should have some prior experience considering social aspects of technology. In a corporate setting, this might include user experience professionals and user researchers, members of "ethical technology" and "responsible innovation" teams, or subject-area experts, such as privacy and accessibility advocates. In an educational setting, this might include faculty, educators, researchers, and students who have some prior expertise or experience with studying social aspects of technology (such as science and technology studies, human-computer interaction, information science, technology law and policy, and related fields).

Goals of *Timelines*

Timelines serves four different goals that are based on research on best practices for considering social values and ethics in relation to technology design:

Goal 1: Recognize how values are differently experienced. Social values do not have single definitions that are applicable in every situation. The process of developing social media posts for users with different perspectives, as well as the concluding discussion, are meant to help surface multiple viewpoints and experiences of values. *Timelines* aims to help understand what definitions of a social value (e.g., privacy, security) are at play in a given situation. For instance, whose privacy and security are at stake? Why do these individuals or groups seek privacy and security? What do they see as threats to their privacy and security? The answers to these questions will vary for different stakeholders, technologies, and contexts, leading to diverging definitions of privacy and security that need to be addressed.

Goal 2: Identify how direct and indirect stakeholders may be affected. Timelines can help identify the individuals or groups who may be directly affected by a new technology, as well as others who may be indirectly affected. For example, if considering hospital patient records systems, direct stakeholders may include doctors, nurses, and insurance companies, while indirect stakeholders might include patients and their families. Past research on value-sensitive design has emphasized the importance of considering both the direct and indirect stakeholders of a technology.[13] Other research has shown how ethical issues can arise in relationships with technologies that go beyond "use,"[14] such as non-use,[15] maintenance and repair,[16] policymaking,[17] and re-purposing and re-appropriation.[18]

Goal 3: Create rich fictional worlds in an approachable way. Creating imagined future worlds can be a powerful tool for considering ethical implications of technology.[19] However, doing this imaginative work can be challenging for those who do not regularly practice forms of design, art, and media production. *Timelines* provides a structured process that leads participants to create fictional worlds using news headlines and social media posts, which are familiar everyday forms and should be accessible to a broad range of people.

Goal 4: Think about broader social effects related to new technologies. Creating stories through news headlines helps participants think about the broader dynamics of the world that might be at play.

Timelines: A How-To Activity Guide

This section provides an overview of how to run the *Timelines* activity in your own group, classroom, or organization. This includes the steps of *Timelines*, facilitation tips, and an example from a group that has participated in the activity. More information, including a peer-reviewed research paper and templates for a digital version of this activity, can be found at http://tinyurl.com/TLActivity.

Timelines is typically played in groups of 3-6 people, but the activity can be run with larger groups, as well as with fewer people. It can even be run as an individual activity to guide self-reflection. Large groups can be split into smaller teams that conduct the activity in parallel.

Each step also provides an example of how one group conducted the *Timelines* activity. This group was convened as part of a research study to evaluate how the *Timelines* activity would work in group settings. The group included three individuals enrolled in a technology-focused graduate degree program, several of whom had prior experience working at technology companies in user experience roles.

SETUP AND MATERIALS
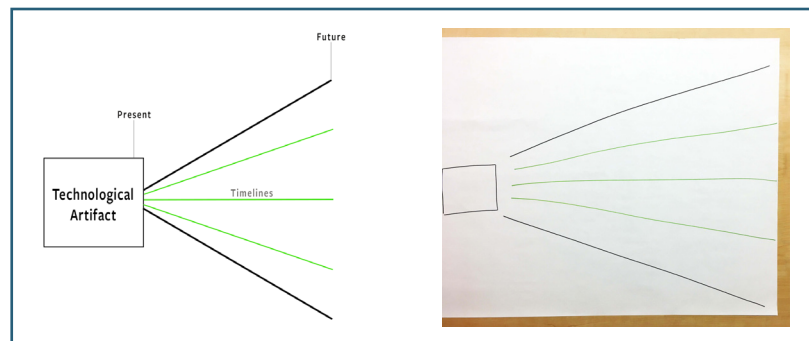
The *Timelines* triangle activity board draws inspiration from the "futures cone," a visual representation commonly used for foresight analysis.[20] The left side of the triangle represents the introduction of a new technology or artifact. The lines spreading to the right indicate different possible stories about the artifact as time progresses. Participants use a large version of the timeline triangle to create a storyworld to illuminate various ways a technology may be used and adopted. The timeline triangle can be easily drawn on a large piece of paper or whiteboard.

Face-to-Face Version

Materials required for an in-person round of *Timelines* include:

- A large timeline triangle drawn on a large piece of paper or whiteboard
- Sticky notes
- Index cards
- Sharpies or markers

Digital Version

- A round of *Timelines* can be undertaken online with a shared digital whiteboard that allows participants to place virtual sticky notes. Part of the whiteboard should include blank space for participants to place notes in a free-form manner, and part of the whiteboard should include the triangle template for participants to place notes in a more structured fashion.
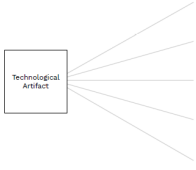
Start the activity by providing an overview to participants. For example:

"In today's activity, we will create a range of future stories surrounding [a technology], and explore those stories from different viewpoints. The goal of this activity is to think about possible futures, and critically reflect on the impacts of [the technology] for diverse stakeholders in a range of contexts, focusing on social values like privacy and accessibility. Note that, while we are thinking about the future, we are not predicting the future. Rather, our goal is to explore and reflect on a range of possibilities and different points of view."

STEP 1: CHOOSE AN ARTIFACT AND CONTEXT

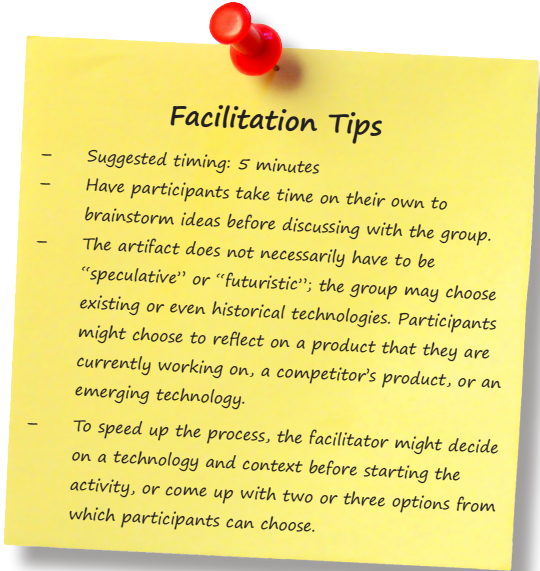An example of an instruction slide shown to participants.

Participants first decide on an "artifact" — a technology, system, or feature that they want to explore — as well as a social context where it might be used. Some groups may already have an artifact in mind, while other groups may need more time to brainstorm. Participants are instructed to write down their artifact and context on a sticky note and place it in the square on the left side of the triangle.

Facilitation Tips

- Suggested timing: 5 minutes
- Have participants take time on their own to brainstorm ideas before discussing with the group.
- The artifact does not necessarily have to be "speculative" or "futuristic"; the group may choose existing or even historical technologies. Participants might choose to reflect on a product that they are currently working on, a competitor's product, or an emerging technology.
- To speed up the process, the facilitator might decide on a technology and context before starting the activity, or come up with two or three options from which participants can choose.
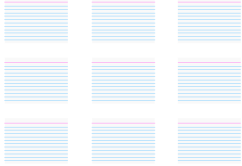
Step 1: Example

As their "artifact," the group chose to discuss a webcam that monitors a user's posture and physical activity in the workplace and in classrooms. This was based on a prototype technology that the participants had seen and that they wanted to discuss further.

Physical Activity monitoring w/ webcam in workplace/classroom

STEP 2: GENERATE STAKEHOLDERS

2. Generate Stakeholders

• Brainstorm stakeholders of this artifact, write one stakeholder on each index card

• **Tip:** Try to think of stakeholders who are **individual people**, and stakeholders who are groups or **institutions**

Using index cards, participants should next brainstorm lists of stakeholders (including individuals and organizations) who may be likely to use or engage with the artifact. Stakeholders could be directly related to the artifact, or they may have a more indirect connection. The facilitator should prompt participants to brainstorm a wide variety of stakeholders, including individuals, groups, and institutions, and populations often left out of the design process. Participants should share their brainstormed lists of stakeholders with each other.

Ask participants to place the stakeholder index cards to the side for now; they will be used again later. Next, using sticky notes, participants should individually brainstorm potential news headlines related to their artifact. News headlines are a form that most people are familiar with and can easily create in a short amount of time. Headlines also help participants think about potential large-scale events and shared effects of technologies.

Facilitation Tips

- Suggested timing: 3-5 minutes for individual brainstorming, 5-15 minutes for group sharing.
- Splitting this step into individual brainstorming and group sharing stages allows individuals to self-select what they want to share with the group.
- If the activity is conducted at a large table, participants can sort and group their stakeholder index cards when they share them.
- Participants can continue brainstorming new stakeholders while sharing them.

- Encourage participants to think of a broad range of stakeholders. Ask questions like: "Who might not like this?" or "Who might indirectly be affected by this?" or "Who has the power to make changes to this?"
- Encourage participants to think about users with different backgrounds and viewpoints.
- Encourage participants to think about relationships beyond "users," such as people who refuse or do not use the system, those who administer it, those who maintain and repair it, those who might pose a threat to the system, those who create or sell it, etc.

Step 2: Example

Policy-makers

Health insurers

The participants brainstormed a list of more than 30 direct and indirect stakeholders, including: health insurers, medical providers, chiropractors, school boards, parents of students who might be subjected to the posture technology, students' friends, policymakers, employees at companies where the system is used, CEOs and C-suite executives at companies where the system is used, law enforcement, third-party data purchasers, and rival technology companies.

STEP 3: BRAINSTORM NEWS HEADLINES

3. Brainstorm News Headlines

• Write headlines on a sticky note

• What happens when this artifact is deployed in the world?

• **Tip:** Try to come up with at least 1 more positive and 1 more negative headline

Ask participants to place the stakeholder index cards to the side for now; they will be used again later. Next, using sticky notes, participants should individually brainstorm potential news headlines related to their artifact. News headlines are a form that most people are familiar with and can easily create in a short amount of time. Headlines also help participants think about potential large-scale events and shared effects of technologies.

When facilitating this step, verbally prompt participants to consider creating headlines that portray both positive and negative events or perspectives on the technology. We also suggest that participants try to have fun in creating a diversity of headlines, including blog posts or "clickbait" headlines.

Facilitation Tips

- Suggested timing: 5-10 minutes
- Encourage participants to have fun with this step. Clickbait headlines, as well as traditional headlines, are fine!
- Encourage participants to try to come up with at least one positive and one negative headline.

- Try to avoid creating completely dystopian or utopian stories. Reminding participants to create both positive or negative headlines helps prevent extremes.
- You can push participants to consider stories beyond the context they started with. Ask them to consider what happens when the technology gets adopted in new contexts or locations, or by new populations.

Step 3: Example

The group came up with many headlines related to a posture camera app. These include:

- *Posture is the new form of authentication*
- *White, wealthy schools ban posture cams*
- *Kids who move are less successful in life*
- *How to train yourself to "sit rich"*
- *Top 10 ways to lower your health insurance premium with posture apps*
- *New way to measure the success of your workers/students*
- *Employee camera went off during intimate moment at work; employee fired*

STEP 4: PLACE HEADLINES ON THE TIMELINE

4. Place Headlines on the Timeline

• Try your best to place headlines in a chronological order

• Verbalize if it comes "after," "before", "at the same time," or "separate from"

• Conflicts are ok!

• Feel free to brainstorm new headlines
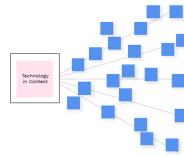
Facilitation Tips

– Suggested timing: 10-20 minutes
– While headlines do not need to be placed in a "strict" chronology, placing them roughly in a logical order provides a useful, flexible set of constraints and helps elicit discussion about secondary and tertiary effects, as well as potential unanticipated outcomes.
– Each story can be created along a different timeline in the triangle.
– When participants place a new headline on the timeline, have them verbalize whether it comes before, after, at the same time as, or separate from another headline already on the chart.
– Encourage participants to continue writing and sharing new headlines as new ideas come up.

– Some participants may be worried that some of the headlines seem to conflict with one another. This is fine! Real technologies get adopted and used in varying, sometimes conflicting ways, and that should be reflected in these activities.
– One way to structure this section is to have participants create several distinct stories (e.g., sticky notes placed along each line of the triangle represent a different story about how the technology gets adopted and used). Then ask participants to consider how those different stories of adoption and use could occur simultaneously. For instance, different stories might reflect different countries' regulatory approaches to technology issues; how the same technology gets adopted differently in different locations; or how some groups might resist the technology while others embrace it.
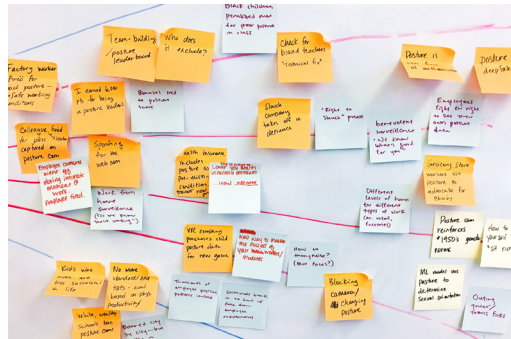
In this step, participants share their headlines with each other and take turns placing their sticky notes on the large shared timeline triangle. In doing so, they create multiple stories or chains of events related to the technology. Participants are also welcome to create new headlines and place them on the timeline triangle as the conversation progresses.

Participants may express concerns that the headlines do not form a single coherent story, so the facilitator should remind the group that having conflicting or non-congruous headlines is acceptable and even encouraged. Point out that people's experiences with technology are multiple and uneven, particularly across different geographic, political, and demographic contexts. The timeline triangle allows participants to tell multiple stories about the same technology, and reflecting these uneven (and sometimes conflicting or unsettling) experiences on the timeline is an important part of the process.

Step 4: Example

The group used their headlines to create different stories about the posture-monitoring technology. Each story is told through a different grouping of headlines.

One grouping explored how a posture monitoring camera might be used (or misused) in a variety of workplace situations, and what other data the cameras might collect.

- "Factory worker fired for bad posture, unsafe working conditions"
- "Teacher colleague fired for jokes captured on posture cam"
- "Employee camera went of during intimate moment at work; Employee fired"
- "I earned 6000 points for being a posture leader!"
- "Spoofing for the webcam"
- "Bonuses tied to posture score"
- "Work from home surveillance: 'So we know you're working'"

Another grouping of headlines reflected a story about how the posture camera technology might be adopted by schools and what debates might occur. Why might this system be appealing for schools to adopt? What types of schools might view the technology as intrusive surveillance?

- "Kids who move more are less successful in life"
- "No more standardized tests —evaluations based on physical productivity"
- "White, wealthy schools ban posture cams"
- "Banned city by city, but mostly in white, wealthy schools"

A last grouping of headlines tried to imagine ways in which the posture cameras might be resisted by some workers, but seen as useful by others.

- "Slouch company takes off in defiance"
- "'Right to Slouch' Protest"
- "Benevolent Surveillance: 'We know what's good for you'"
- "Employees fight for right to see their own posture data"
- "Grocery store workers use posture data to advocate for chairs"
- "Posture cam reinforces 1950s gender norms"
- "How to train yourself to 'sit rich'"

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STEP 5: CREATE STAKEHOLDER SOCIAL MEDIA POSTS

5. Stakeholder Social Media Post

• On another index card or sticky note, create a social media post written from the perspective of one of your stakeholders

• Place the social media post in a stack under its "author" stakeholder
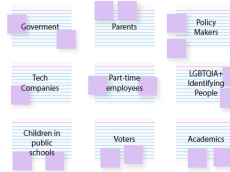
Now that participants have created a broad, imagined world focused on major events, they can consider the events and changes in that world from the viewpoints of different stakeholders. Using sticky notes and the stakeholder index cards from Step 2, participants create social media posts from the perspectives of different stakeholders, and physically attach each note to a stakeholder index card. Social media posts should have an author, and a short piece of content depicting their viewpoint or experience (about 1-2 sentences is usually a good guideline). A social media post written by an individual might depict a complaint, a positive experience, or a short, punchy personal opinion. A social media post written by an organization might depict an advertisement, promotion, or public comment on a controversy. While most social media posts that participants create are text-based, participants can also imagine different types of links, images, or videos that might be shared in these social media posts.

Facilitation Tips

– Suggested timing: 5-10 minutes
– Encourage participants to consider writing social media posts from the perspectives of a range of stakeholders who may experience the technology differently.
– Participants may consider choosing a specific headline from the timeline triangle and create social media reactions from different stakeholders' viewpoints.

Step 5: Example

Next the group generated social media posts to highlight how diverse stakeholders might respond to the headlines. In this example, a health insurer suggests that the posture app technology can usefully identify depression in children, while at the same time a parent sees the posture apps as a potential threat to children and celebrates when their child's school bans the technology measuring children's posture. These reflect differing responses to the technology, and also raise questions about how different stakeholders might view values of health, surveillance, and autonomy in relation to the posture technology.
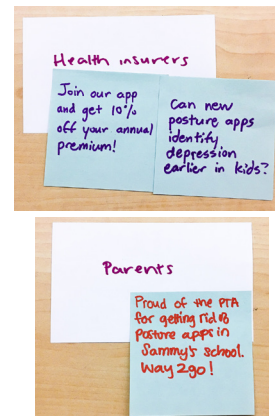
STEP 6: SHARE-OUT AND DISCUSSION

6. Share-Out & Discussion

• Read the social media posts aloud from your group

Discussion questions:
• What themes came up from this activity?
• What was surprising to you?
• What things are missing from our stakeholders, headlines, and social media posts?
 • What aspects from the headlines and social media posts is already occurring today?

As the final step, participants share their social media posts, and shift into a broader discussion to reflect on any ideas or insights that may have emerged through the activity. The discussion asks participants to step back from the fictional world and begin to draw connections between the activity and their present practices.

A common reflection we have heard from participants is that while the future stories are fictional, the issues they surface—such as inequalities, biased algorithms, or systems of power—are surprisingly similar to challenges they face today. This suggests that the activity can be useful for helping people reflect on their current technical practices.

Facilitation Tips

– Suggested timing: 5-15 minutes
– Suggested discussion questions:
  • What themes came up for you from this activity?
  • What was surprising to you?
  • What is missing from our stories and social media posts?
  • What aspects from the headlines and social media posts are already occurring today?
  • What might you change or do differently in your own work after completing this activity?

Step 6: Example

The participants' reflections spanned many topics and perspectives, including the following themes (quotes have been edited for clarity):

Highlighting conflicting perspectives. Responding to a participant's social media post expressing joy about a gamified version of the posture app, another participant said, "I had a similar social media post, but reversed. Like 'I was so points hungry that I got my co-worker fired for a posture game.' Like feeling guilty about it."

Connecting *Timelines* stories to existing technologies and issues. A participant reflected, "I would be most concerned about the disproportionate effects that it will definitely have with low-income people of color. It has very similar parallels to facial recognition."

> **Debating how technologists might address potential harms.** Participants discussed how they might apply the reflections from the activity in a professional work setting. "Do you as a user researcher say 'the harms outweigh the benefits of this technology and so I don't support it'? Or 'It's better to understand all of this [potential risk] and try to think about how you might from a technical perspective make sure that images or pieces of identifying information are stored in particular ways?'"

OPTIONAL POINTS OF FOCUS & EXPANSIONS

Timelines serves as a general activity framework for structuring discussions about social values and ethical issues related to technology. However, at each step, the activity can be modified to focus more specifically on issues that a researcher, facilitator, or participant may be interested in exploring. Each step can be extended or adapted by incorporating other design tools, and conceptual and analytical frameworks.

ADDITIONAL DESIGN APPROACHES TO CONSIDERING VALUES AND ETHICS

Design interventions can be useful for eliciting discussion and consideration of social values and ethics. Many of these can occur through events like workshops, collaborative design activities, or game-like activities. While researchers have more exhaustively documented and analyzed these approaches,[21] some illustrative examples are discussed below:

CARD DECKS
Designers can use cards to help ask questions about a technology or sort through different types of ideas and concerns they might have.

- *Envisioning Cards* present questions and prompts about different types of stakeholders and uses of technology to help lead discussions about values related to technology. These cards are organized into four "suits," which ask questions about: stakeholders; time (the long-term implications); social values, and pervasiveness (the contexts where technologies are used).[22]
- *The Security Cards* feature questions and prompts to help participants think about different types of computer security threats, as well as the adversaries that might cause these threats. These cards are organized into four "suits," which ask questions about the human impact of security threats, adversaries' motivations, adversaries' resources, and adversaries' methods and practices.[23]

GAMES AND ROLE-PLAYING
Interactive games and role-playing aim to help participants think about technologies from different points of view.
- *Adversary Personas* is a role-playing game that helps teams think broadly and creatively about cybersecurity threats. It is well-suited to individuals who have not received formal security training. The game motivates participants to think about what they are protecting, who their adversaries are, and what their adversaries' motivations and resources might be.[24]
- *Security Fictions* is an activity that helps software developers role-play and surface discussion of potential technical and social attacks to a system that might cause harm.[25]

- *Privacy-by-Design: The Game* leads players to take on roles within a fictional mobile app startup company, and asks them to make decisions about their company's data collection and usage policies. The players face different constraints on their financial resources, and learn about different consequences of their data practices.[26]
- *Judgment Call: The Game* is a group activity in which participants create fictional product reviews of technologies. written from different stakeholder perspectives. The goal is to surface ethical considerations related to AI technologies.[27]

CREATING "WHAT IF?" SCENARIOS

Activities based on "What If?" scenarios help participants imagine what could happen with a given technology — and what could go wrong.

- *The Black Mirror Writers' Room* asks participants to take a technology and use it to create a summary of an episode of Black Mirror, a dystopian science fiction series. The purpose is to explore potential unethical uses of technology.[28]
- *The Wheel of Implications* is an activity designed to surface secondary and tertiary effects of a technology. First, participants identify potential immediate effects of a technology, ranging from positive to negative. For each of those immediate effects, participants then identify potential secondary effects that range from positive to negative. This process is then repeated to identify tertiary effects.[29]

TOOLKITS

Toolkits provide guidelines or activities to help during the design process.

- The *Microsoft Inclusive Design Toolkit* considers a broader range of viewpoints, identities, and abilities during the design process.[30]
- *Diverse Voices* is a guide for how to involve under-represented groups in conversations and discussions about technology use, design, and policy.[31]
- *Loaded Dice* is a brainstorming kit to imagine new types of Internet of Things technologies. One die has six types of sensors (e.g., a temperature sensor, microphone, and light sensor), while a second die has six types of actuators (e.g., LED lights, a speaker, and a heating surface). Rolling the dice helps designers think about potential new future technologies, such as a heating surface that responds to certain types of sounds.[32]
- *Tiles* uses a deck of cards to help participants imagine new types of Internet of Things technologies. The cards are divided into multiple suits, including human interactions, feedback and outputs, data types, ways to connect devices, purposes, and types of physical objects.[33]

SPECULATIVE DESIGN AND DESIGN FICTION

Speculative design and design fiction lead participants to create an "artifact" that could come from a possible future world (such as a product catalog from the near future) in order to ask, "what would need to be true in the future for these artifacts to be able to exist?" Examples from academic research include:

- A story about a technology inspired from the Dave Eggers science fiction book *The Circle* focused on discussing the privacy and ethical questions that emerge when using public data for research.[34]
- A fictional company that uses brain computer interfaces as a part of gig work, to discuss how brain computer interface technologies could exacerbate existing labor ethics issues.[35]
- A fictional catalog of speculative menstrual technologies to surface how forms of collecting, analyzing, and sharing menstrual data could be used for surveillance, with disproportionate effects along gender and power dimensions.[36]
- A set of documents and materials depicting a fictional company's diversity and inclusion initiative to discuss how well-intentioned corporate diversity efforts can nevertheless reinforce forms of the racism, ableism, and sexism they are trying to prevent.[37]

SECURITY AND PRIVACY FOCUS

Modifications to the *Timelines* activity at several different steps can be used to highlight aspects of security and privacy. In the course of brainstorming stakeholders, participants can be directed to specifically list a diverse range of stakeholders that either seek privacy and security protections, or that might violate others' privacy and security. Some stakeholders may fall into both categories (for instance, in some situations a large technology company or government agency might be viewed as seeking security, while in other cases these same stakeholders may be viewed as violating others' security).

Merrill's Adversary Personas[38] and Denning et al.'s Security Cards[39] both provide cards that can help participants consider the resources and motivations of a security adversary. Participants can use these cards to help develop adversarial stakeholders that might seek to violate others' privacy and security. It can be useful to keep the news articles depicting general changes in the world, and use the social media articles to depict specific privacy and security harms. This allows participants to use the news articles to generate a range of situations and contexts where security and privacy might come into play.

Social media posts can be used to describe specific security and privacy harms experienced by different stakeholders. To help participants brainstorm different harms, they might use the Adversary Personas' or Security Cards' human impact cards, which describe different effects security can have. When considering privacy, participants might use a framework that defines types of privacy harms to create social media posts that depict different types of privacy violations. For instance, Solove's taxonomy of data harms describes types of privacy harms that can occur from data collection (such as surveillance), data processing (such as unwanted aggregation or re-identification), information dissemination (such as unwanted disclosure or a breach of confidentiality), and personal invasions (such as interfering with people's decision-making processes).[40]

In one use of *Timelines*, participants were given a set of cards that listed different types of data privacy harms, like aggregation, and they were told to create social media posts discussing those privacy harms.

The discussion can be oriented to specifically tease out different conceptions of privacy and security. Questions to participants might include: Why should this be private? Whose privacy is at stake? What is being protected by privacy? Who and what is violating privacy? Who or what mechanisms are supposed to provide privacy? And, where and when is privacy required?[41] This type of inquiry helps structure the bottom-up conversation to help understand what definitions and conceptions of privacy are at play, and can help start a conversation about which ones need to be addressed, as well as what social or technical mechanisms can be used to address these harms.

ADDITIONAL EXPANSION POINTS

Some other ideas for potential extensions and adaptations to the *Timelines* exercise are listed below.

Step 1. Artifact and Context

You might want to add structure the specific artifact or context that participants discuss. Some ideas for this include:

- Using design toolkits like "Loaded Dice"[42] or "Tiles,"[43] which help designers come up with new types of Internet of Things artifacts.
- Choose a technology and context from speculative or science fiction for participants to discuss. For instance, several researchers have used fictional smart devices presented in Dave Eggers' novel *The Circle* as the basis for design activities.[44]

Step 2. Stakeholder Creation

Instead of having participants freely brainstorm about possible stakeholders, you can introduce additional constraints that help participants think about specific types of stakeholders. Some examples include:

- Using the *Envisioning Cards* (a set of value-sensitive design ideation cards),[45] the "Stakeholder" suit can help stakeholder ideation.
- Use Microsoft's Inclusive Design toolkit personas[46] to help build a list of stakeholders who represent a diverse range of physical abilities.
- Use characters and personas from popular fiction as stakeholders.[47]

Steps 3-4. News Headlines

- Incorporating techniques from the field of scenario planning can help to identify trends in the broader world that could inform the headlines developed through *Timelines*. For instance, scenario planners sometimes use a framework called "STEEP" to ensure their scenarios integrate social, technological, economic, environmental, and political developments.[48] As a facilitator, you can push participants to make sure their news articles and resulting chains of stories reflect potential changes in the five STEEP areas.

- The Envisioning Cards[49] include suits for "Time" and "Pervasiveness" that pose questions that can help participants' ideation about how artifacts get adopted and used in different contexts.

Step 5. Social Media Posts

Social media posts provide an opportunity for participants to consider multiple definitions of the same social value, such as how different stakeholders might have different types of privacy or security concerns about the same technology.

- Incorporate frameworks that describe different types of definitions of social values. For instance, researchers have created frameworks that describe multiple definitions for values such as privacy,[50] fairness,[51] and AI ethics.[52] Participants can be instructed to make sure each social media post reflects a different type of concern or definition of a particular social value.
- Incorporate findings from user research (such as focus groups) or from customer service feedback the organization has received.

CONSIDERATIONS FOR FACILITATORS

We designed *Timelines* to be led by a facilitator with at least a basic understanding of how social values connect to technology, such as a UX professional guiding a team, or an educator teaching a technology and ethics class. While the design of the activity and instructions help provoke participants' discussion, the facilitator plays a crucial role in steering the discussion.

Over multiple iterations of facilitating, we found that splitting most steps into an individual brainstorming stage and a group sharing stage allows individuals to self-select what they want to share with the group. Earlier iterations did not include time for individual brainstorming, but participants felt that not having this time created pressure to come up with a good idea to share with the group. Providing time for individual brainstorming also helped people who were resistant to coming up with ideas as it gave them time to think.

While facilitating, we tried to notice if certain people were dominating the conversation. In these cases, we would prompt "go arounds," where each participant would contribute an idea, ensuring the process integrated a range of voices.

The creation of headlines is intended to help participants explore the multiplicity of relationships and effects related to technologies. It was our intention to avoid the creation of fully dystopian and utopian worlds, as these hyperbolic extremes overlook more probable outcomes that might occur in between.[53] Some groups easily think of many negative headlines, but have

trouble coming up with positive ones. To move participants away from creating purely dystopi-an worlds, it is useful to introduce the verbal prompt, "positive and negative for whom?" Often when harms and negative outcomes occur, another stakeholder (often in a position of power) obtains some benefit. This prompt is not meant to suggest that harms are offset by benefits, but rather provides an opportunity to get participants to think about the world from multiple points of view.

Furthermore, encouraging participants to develop a positive headline often elicits discus-sion about unanticipated or unintended negative effects that might follow, which would not necessarily arise from a purely dystopian world (such as how a well-intentioned public health technology can lead to unequal health outcomes). Prompting participants to create more complex storyworlds, in which benefits and harms of technologies are unevenly shared, helps convey how harms can arise from everyday choices in the design, deployment, and adoption of technologies; it does not require a dystopia to identify harms stemming from technology design and use. Framing values and ethics as embedded in everyday decisions can help connect participants' fictional stories to their own everyday practices.

Throughout the activity, facilitators should explicitly prompt participants with reflective ques-tions to expand their thinking. For instance, you might prompt participants with broad sugges-tions during their brainstorming, such as "have you considered an adversarial stakeholder?" or "have you thought about people who are indirectly affected by the system?" A common con-cern raised by participants is that their group's news headlines do not form a single coherent story. Facilitators can point out that people's real experiences with technology are multiple and uneven, particularly across different geographic, political, and demographic contexts. Depicting these uneven (and sometimes conflicting) experiences on the timeline is a useful reflection. Including conflicting or non-congruous headlines is encouraged as a way to tell multiple stories about the same technology.

The concluding discussion serves as an opportunity for participants to draw connections between the fictional world created in the activity and their everyday practices. While the main activity steps (Steps 1-5) help create an open space where participants can suggest new alternative ideas, this step allows facilitators to explicitly prompt participants to articulate how values, ethics, and politics are relevant to their own technical design and research practices.

ADDITIONAL USES AND OUTCOMES

The *Timelines* activity has been used multiple times in classroom settings, and at workshops where academic researchers and technology practitioners discuss the ethical implications of technology. The activity is successful at helping people think about multiple potential future worlds, as well as surfacing unanticipated risks and harms.

Timelines can be used in a range of settings to achieve different outcomes:

- In an educational environment, it can be used as part of a class (for example, on ethics in computer science or on social aspects of technology) to help students think critically about the potential intended and unintended ethical outcomes related to technology.
- It can also be used in a technology company, helping practitioners develop reflective thinking skills around the ethical implications of technology. *Timelines* can be used to help identify potential risks and harms with products early in the product development process. *Timelines* can also be conducted outside of the product design process, such as during onboarding or other types of training, or when helping cross-functional teams build a shared understanding about values and ethics.
- *Timelines* can also be used in a user research process. By asking potential users or other stakeholders to create stories about a technology, researchers can gain insight into the potential needs and concerns of users and stakeholders.

Conclusion

Many companies have been caught off guard by the negative impacts of new technologies they have deployed. In 2016, Twitter users manipulated a Microsoft chatbot to make misogynistic and racist remarks within 24 hours of its release.[54] The advertising algorithms on platforms such as Google and Facebook that allow advertisers to better reach potential customers have been found to lead to gender biases and discrimination when job listings are being advertised.[55] In 2020, when Zoom started to be adopted more broadly in many new settings during the pandemic, its default settings made it easy for security problems such as "zoombombing" to occur.[56]

While it is impossible to anticipate every possible misuse of a technology, many potential (and likely) unintended impacts of new technologies can be surfaced in a relatively short amount of time through a structured process. Using tools like *Timelines* can help organizations identify changes that need to be made to a technology's design or use policies. Importantly, these changes can be made before a design or a policy is finalized, and before real-world harms occur. Many negative impacts that may seem obvious in hindsight could be avoided by investing a modicum of time and resources on anticipating what could go wrong.

Timelines creates a space for participants to propose and surface discussion of values, ethics, and consequences related to a given technology. *Timelines* provides a useful integration of several theoretical perspectives. The activity also makes use of everyday, familiar forms — news headlines and social media posts — and it can be carried out in a wide range of settings with diverse groups of people.

Moving forward, the *Timelines* activity can be utilized in different ways by educators, practitioners, researchers, and other values advocates. For instance, it might be used as an educational activity with computer science students, as a training activity in an industry setting, as a probe to understand stakeholder concerns about a product in user research, or as a way for policymakers and non-technical stakeholders to think about values in emerging technologies.

While *Timelines* alone will not solve a values or ethical issue, it can be a useful tool to help explore potential situations and to speculate and present alternatives. *Timelines* encourages nuanced discussions and can surface and elicit important insights about values and ethics related to technology development and use.

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Acknowledgments

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