

CARNEGIE MELLON UNIVERSITY

School of Architecture
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TITLE:

Co-creative Community Installation

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Co-creative Community Installation

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Abstract

AI has been used widely for government decision-making process. In Pittsburgh, public algorithms are implemented on various fields including child welfare, housing and crisis prevention, which are increasingly shaping major aspects of their lives. However, community members' understanding of the AI-based decision making tools remains ambiguous. In this paper, we imply co-creative design workshops with community members to learn what aspect of public algorithms that they are interested in, and envision how to inform them efficiently about public algorithms. We then discussed potential disadvantages and challenges of public algorithms. Finally, a potential solution, Tangible Poster, to collect community members' opinions is introduced.

Keywords

Participatory design, co-creative, tangible media, civic engagement

Table of Contents

1. Introduction
 - 1.1 Public Algorithm
 - 1.2 Motivation
 - 1.3 Research Question and Hypotheses
 - 1.4 Contribution
2. Background
 - 2.1 Public Algorithms in Allegheny County
 - 2.2 Design Theory and Social Framework
 - 2.3 Related Works
3. Method
 - 3.1 Human-centered Research
 - 3.2 Participants Recruitment
 - 3.3 Consent
 - 3.4 Workshop Protocol
4. Findings
 - 4.1 Participants Demography
 - 4.2 Affinity Diagram
 - 4.3 Findings
5. Conclusion
6. Limitation

1. Introduction

1.1 Public Algorithm

AI has been used widely for government decision-making process, which has tremendously changed citizen life. It has been reported that more than 40,000 Michigan citizens have been falsely charged thousands because of unemployment fraud made by algorithms of Michigan Unemployment Insurance Agency.[1] In New York, small food businesses struggled to survive from screen algorithms made by U.S, department of Agriculture because of dubious fraud charges.[2] The error rate of algorithms and the potential problem of bias are harmful for public interests and rights, which call on action from community members. In Pittsburgh, dozens of algorithmic technologies are in use by Allegheny County government agencies regarding to child welfare, housing and crisis prevention. For example, family screening tool is a predictive modeling for child welfare. Housing assessment is to prioritize admission for supportive housing services.[3] Those algorithms are related closely to citizen life. However, community members' understanding of the public algorithms remains ambiguous and they need to be informed of the influential technologies.

In our study, we will use “public AI/algorithms” to represent community-facing AI decision-making tools. Public algorithms are prompted by citizen's data, and use the data to build artificial intelligence models to predict the risks or benefits. For example, in the Family Screening Tool, the government collects data on the count of months spent in Allegheny County Jail, count of days spent in Permanent Supportive Housing, count of child welfare referrals, etc. The predictive risk model integrates and analyzes the data to predict the likelihood of each person involved in an allegation of child maltreatment. If the person's score is higher than the threshold of ‘mandatory screen in’, the allegations in a call must be investigated and the child of the family will be removed from home.

1.2 Motivation

Civic engagement is a board and popular topics in academic area. Multiple methods, including but not limited to theoretical frameworks, interactive installations, and digital platforms[3][14][16], are introduced to address public issues, But mostly are aim to solve public issues in “real world“, such as transportation, community meeting, community charity etc. But nowadays, with the development of artificial intelligence, there are more and more public issues in “digital world” regarding to the AI-based decision-making tools like public algorithms.

Allegheny Housing Assessment is a decision-making tools using machine learning method to prioritize people experiencing homelessness for permanent housing. It uses data from jail booking, emergency room record and other data from Allegheny County human services to predict the risk of the homeless people will have. The higher score the homeless individual have, the fronter priority this individual will have for permanent housing. This machine learning algorithm to make the prioritization seems fair and accurate because it use the data from administrative organizations instead of self-reported data. But during my interview with government officials working on Allegheny Housing Assessment, the official told me that this algorithm has made several wrong predication, making homeless people experiencing life threatening issues can't get prioritized for the housing service. For example, one homeless people have diabetes and need refrigerator to store insulin. But he doesn't have high score, which means that the algorithm doesn't think he have high risk and urgent need for housing services. Both the government officials and the homeless individuals feel frustrated about the algorithm, but they have nothing to do with the algorithm.

This talk with the frontline worker from Allegheny county motivate me to explore ways to empower citizens in the AI decision-making process. What behind the AI decision-making tools is the distribution of power. Unlike the traditional decision tools, AI makes the non-professional more confusing. If the citizens without specific knowledge on computer science, they can't join in the design and feedback of the AI decision making

tools. The high professional and technical threshold obstacles the grassroots to speak up their voices. My motivation of this research is to help community members to engage in the whole life cycle of AI decision-making tools, including informing, ideating, designing and feedback. To help community members to engage in the loop of AI decision making tools is to help them re-gain the power in the digital ages.

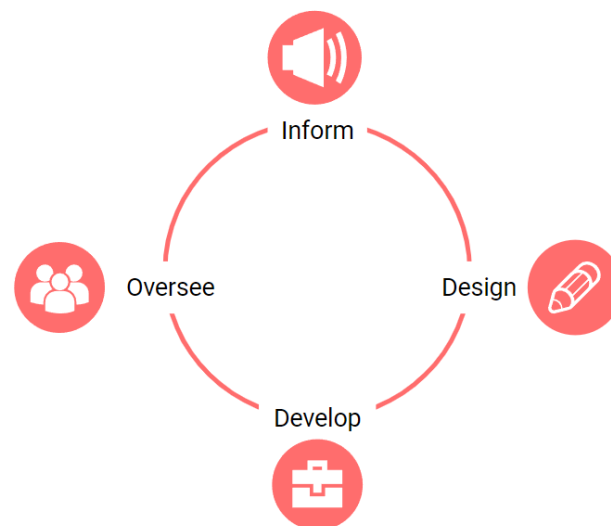


Figure 1: Lifecycle of AI decision-making tools

The experience and other research on public algorithms[5] suggests that AI decision-making process should be under the intervention of citizens. To help the community members to regain power is to include them in the whole process. I envision the future of the lifecycle of public algorithms is a participatory approach, which contains four parts: the informing, designing, developing and overseeing. The first step is to inform the community members of which the public algorithms has existed and implemented in the society. The next is to co-design the public algorithms with the public, to discuss what kind of new algorithms should be implied, what is the challenges and benefits of these new algorithms. The development of the public algorithms should be explainable and transparent, through value sensitive method. For example, the government could conduct workshops to discuss which factors should be considered in the public algorithms and how to improve the accuracy of the

public algorithms. Finally, after the implementation of the public algorithms, the public have the right to monitor and oversee the public algorithms.

As mentioned above through the whole life cycle of AI decision-making tools, the first step is to help community members to realize the occurrence and importance of public algorithms. In other words, to inform the community members of public algorithms is the start point. Without knowing what roles public algorithms play and why public algorithms matter, community members will not pay attention to the decision made in the digital world, let alone giving their advice and speak up their desires for decision-making process. I also believe informing the public of the AI decision-making tools is not about educating community members, but to hear community members' needs and desires.

1.3 Research Question and Hypotheses

My research question is how to use civic technology to inform community members of public algorithms to help them engage in AI decision-making process. The overarching goal is to advocate and empower the community on public-facing algorithms and to engage diverse community members in designing, developing, and overseeing public-facing. The first step is to inform the public. In this research, I'd like to explore answers for the following five small questions:

1. The current situation on community members' interests and understanding of the public algorithms.
2. If they are interested in public algorithms, what kind of aspect do they want to know? And through which channel do they would like to be informed?
3. If they are not interested in public algorithms, how should we raise awareness?
4. What might motivate community members to engage around local civic technologies?
5. How to effectively inform the algorithm avoiding the display blindness by infrastructure?

Before conducting the research process, I have two hypotheses about how to effectively inform people and what information people want to know. First of all, I suppose that tangible media may be more effective than digital website or social media in informing the public and could reach out to more people. Tangible media refers to physical media which can be touched, shared and interacted. Compared to digital media such as websites or e-books, the physical presence makes tangible media can reach out to more people. Le Dantec points out that social media and websites are hard to reach aging people and young people.[4] The limitation of social media and websites is that if citizens don't follow the government's account, the likelihood of information prompting out to them is very low. On the contrary, if a smart device or infrastructure standing on the road where they pass by every day, they can hardly ignore it. The challenge of smart devices or infrastructure is how to attract the attention of passers-by. The interaction between community members and tangible media should be playful and attractive. Based on the hypotheses that tangible media is an efficient way to inform people of public algorithms, what do they would like to know from the media? And how do we make the AI system explainable and contestable when we introduce public algorithms through the tangible media.

Besides methods to inform people, I'm also curious about the content about public algorithms to share with community members. Another hypothesis is that different groups from different demographic background such as gender, age, race and different living area may interest in different aspects of public algorithms.

To answer those research questions and test my hypotheses, I will use co-creative workshop as the main method to envision how to inform community members about public algorithms. When community members have varying access, incentives, and bandwidth to engage, it is crucial to provide learning opportunities that cater to individuals' skills, interests, and availability. To Understand community needs, I will

investigate various stakeholders' needs through interviews and co-creative workshop studies. To inspire them, I will present some examples created by my storyboards. I see opportunities to leverage accessible public and community spaces (both physical and digital) to better engage community members in informal learning and engagement around technologies that impact their lives.

1.4 Contribution

The contribution of my master thesis is to explore design disciplines on informing public algorithms. To be more specific, 1) help citizens to perceive and understand public algorithms to empower them to engage in the further AI decision-making process. 2) find an efficient method to inform people of public issues. 3) make algorithms especially machine learning method explainable to non-professionals. 4) understand which aspect of public algorithms citizens care about. So that in the future, government officials and developers can pay more attention on this aspect. By doing so, we can raise the awareness of community member, increase the transparency of public algorithms, and enhance the communication between community members and governments.

2. Background

2.1 Public Algorithms in Allegheny County

In U.S., there are multiple cities (for instance, New York, Columbus, Los Angeles, etc.) that have implemented public algorithms in different fields, such as housing, education, transportation, criminal justice, etc. For example, in 2018 the New York city has passed the Local Law 49 about automated decision making tools to help in the public issues. Public libraries in New York use algorithms to decide which books should be stock in the branches.[5] The New York government also use algorithms on education to help assign students to target high schools.[6] Los Angeles applied machine learning models to analysis its transportation, including dynamic tolling.[7]

In this research, I focus on the public algorithms that have been implemented in Allegheny County. According to the official website of Allegheny County [8], there are three main public algorithms that help the government making decisions, Allegheny Family Screening Tool, Hello Baby and Housing Assessment. The Family Screening Tool and Hello Baby are algorithms that predict the risks of children experiencing domestic violence and intervene the violence and protect children. Housing Assessment is to prioritize people who are experiencing homelessness to get the housing services. Those algorithms are based on the data warehouse created by the Allegheny County Department of Human Services, which contains families and individuals data about mental health, aging, child welfare, etc.)

2.2 Design Theory and Social Framework

2.2.1 Public Participation Frameworks

Research shows that community-driven strategies and frameworks are more suitable for public issues than traditional top-down strategies. Social scientist has developed multiple frameworks on how and in which aspect of public issues can citizens joined in. I found that most of those frameworks have similarities with analysis-synthesis

bridge model in HCI field, such as Double Diamond, IBM Loop or IDEO Model. Likewise the analysis-synthesis bridge model, they begin at problem identification, and then go through possible solutions and end at evaluation. The difference between frameworks on public participation and the general UX model is that they take public into consideration. 1) Some frameworks indicate that different stages have different level of participation. For example, the ideation, the first stage of the framework usually has the highest public participation. 2) They use methods which the citizens could contribute to the whole process, such as crowdsourcing. 3) As for the community-based public issues, location plays an important role in public participation. Therefore, the frameworks also use mapping in the solution part.

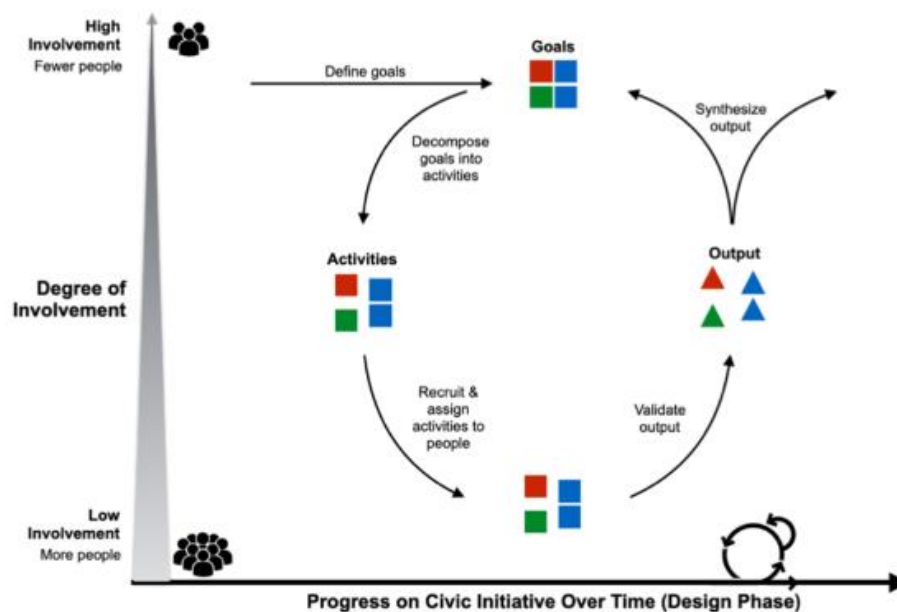


Figure 2: Open Civic Design Framework

Reynante et al proposed Open Civic Design Framework which integrated design thinking, public engagement, crowdsourcing and they realized the vision of the framework by their three existing platforms. [4] Rogers et al developed City Commons framework for citizen sensing and mapping. The frameworks mentioned above are all related to design thinking process, which generally can be concluded as ideation, design, implementation and evaluation. [5] Open Civic Framework takes each design stage's level of public participation into consideration, which is the main attribution of

this paper. Reynante thinks that during identify and define the public problems, more people are engaged while the level of involvement of each individual is low. However, when it comes to in-person community meeting to find the solution and test out the solution, fewer people are engaged. But the involvement of each person in this activity is high, since the tasks are assigned to individuals clearly.

In my research, I will refer to those frameworks to create a participatory environment for community members. The whole research has the same workflow, from ideation, design, implementation and evaluation. I will follow those four stages in my co-creative workshop to explore the public issues on how to inform community members on public algorithms.

However, public participation is not the panacea for all public issues. Public participation has advantage, such as democracy and transparency. But, we should also pay attention to the downside of public participation, especially in the field of participatory machine learning. For example, Mona thinks critically about participation in design practice and machine learning. Because participating as representation or consultation is overwhelmingly costly and how to balance the community-fit and market-fit remains a question.[6]

2.2.2 Design Theory

Scholars have also contributed to analysis current installations and conclude the design principles on the public displays. The essential point is to avoid display blindness. The display blindness refers to that the public displays such as installation or posters don't attract people to view. People are as blind when they pass by the public displays. This situation is not rare and accounts for why some public displays don't achieve the desired effect of advertising.

As Parker concluded, there are four factors to consider in design process: people, time,

community, and location. The people factor refers to protect user's privacy and gain trust from the users. The time factor shows that public displays should adopt to long-term social changes. In addition, public installations should offer values to community members. To be specific, public displays should have collective community identity, create opportunities to community members to better know each other and help community members collaboratively build their communities a better place. Where the public installation should be placed is also important.[17] Other research also validate this theory. Vilaz conducted research about the factor space, where Pinsight plays as a role of multiple, distributed and interlinked devices. She concluded that interlinked and distributed devices can encourage community members to discover.[18]

The above mentioned are design principles for general public displays. When there comes to public display related to AI literacy, there are more disciplines that need to follow. Due to the difficulty to understand the artificial intelligence, Long pointed out that intuitive interaction and explainability should be considered.[16] For example the interaction between human and display should be intuitive, so that users will not feel so difficult to find the clues. Otherwise, users will soon lose the interests on the display and will leave it away. Moreover, the knowledge of AI is complex. So we should also think how to explain the knowledge to non-professional and make them understand the discipline of AI. In this research, I'm planning to help community members to understand public algorithms, which is difficult and complex for non-professional. Hence, the explainability and intuition of the interaction are important design factors.

2.2.3 Social Science theory

Public participation aims to create opportunity for citizens to speak out their needs and thoughts and gives suggestions and feedback to policymakers. Amstein's Ladder is a social science theory to indicate the level of participation of citizens on public issues. The higher level the public is at the ladder, the more power the public gain through the decision-making process. The ladder could be mainly divided to three sections with

nine levels from non-participation to citizen power.

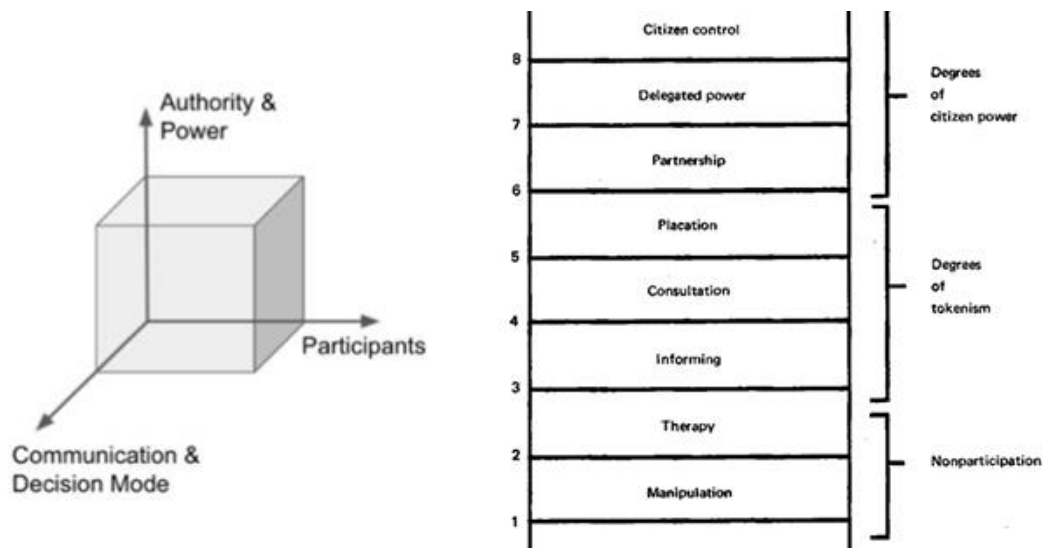


Figure 3: Fung's Democracy Cube and Amstein's Ladder

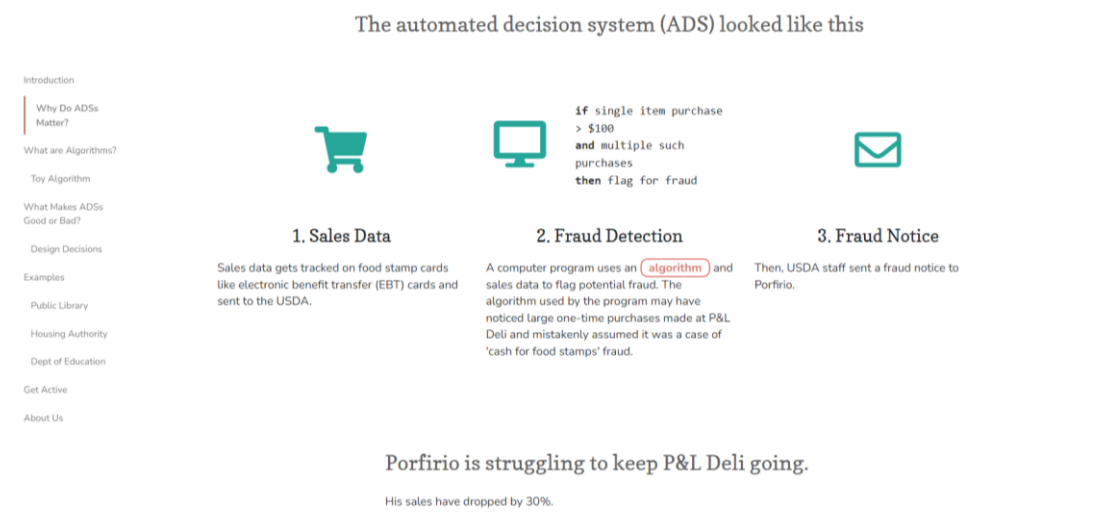
Another influential public participation framework is Fung's Democracy Cube. This cube model is based on the previous ladder model created by Amstein. Besides participation, the cube adds another two dimensions: power and communication mode. The power and authority is how much the visions from citizens become true and the government takes actions. The communication mode refers to what role citizens play in the communication process.[23] Inspired by those participation frameworks, I'd like to consider my research project to provide a more participatory background when conducting the workshops.

2.3 Precedent Projects

2.3.1 Digital Platforms

The solutions of empowering community members are divided mainly to two parts: digital platforms and smart devices. I would like to test the efficiency of those two methods through workshops, which is one of my research goals. By compared those two methods, I will draw conclusions on how to effectively inform the community

members of public algorithms. Through the literature review, I noticed that there is a trend on public participation from digital platforms to smart devices. Last five years, most of research is using digital platforms for civic engagement. But currently, scholars have pay more attention on smart devices while fewer research is about digital platforms.



Over five years ago, scholars developed platforms to facilitate local engagement. For instance, Hansen designed ACTion Alexandria, an online platform, where public issues were posted and community members could submit their thoughts to solve this problem. It made community members and non-profit organization to solve the problems together. [7] Similarly, Harding's platform is also aimed for collaboration of government and citizens, which is focused on the infrastructure maintenance.[2] After the development in academic area, digital platforms for government and citizens collaboration have been implemented in real community environment. The academic innovations have already been commercialized. To list a few of those commercialized digital platforms for public participation, CityVerse, Public Input, NeighborLand, CommunityCrit are e-government platforms for urban planning, infrastructure building, etc.

Those commercialized digital platforms, which function well, represent that the

research on public participation by digital websites have been well explored. In the past, those digital platforms are mainly aimed for public issues in the real world, such as infrastructure or urban planning. At present, researchers tend to imply digital platform to address issues in the digital world. They are more concentrated on building platforms or algorithms with machine learning method. For example, Min used AI framework to let the community members to build their rules. She used pairwise method—machine learning model and explicit rule, which is a comparison between AI and non-AI in community member rule building process. She concludes that machine learning model has higher overall agreement than non-AI method. The top-down method which makes the community members to design is more idealistic, while the machine learning method makes the community members focus on more realistic issues. [8] Smell Pittsburgh is an online platform aimed for air pollution in Pittsburgh. Community members to report which location have the odors and use this crowdsourcing data and air quality data to visualize the air pollution landscape and predict next smell event. [9] There are also researchers focus on the transparency of public algorithms. Kars aims for the transparency of the smart vehicle charging algorithm, where he claims that the need for contestability and transparency for future public decision-making process.[10] In these cases, digital websites or mobile applications are platforms for collecting crowdsourcing data.

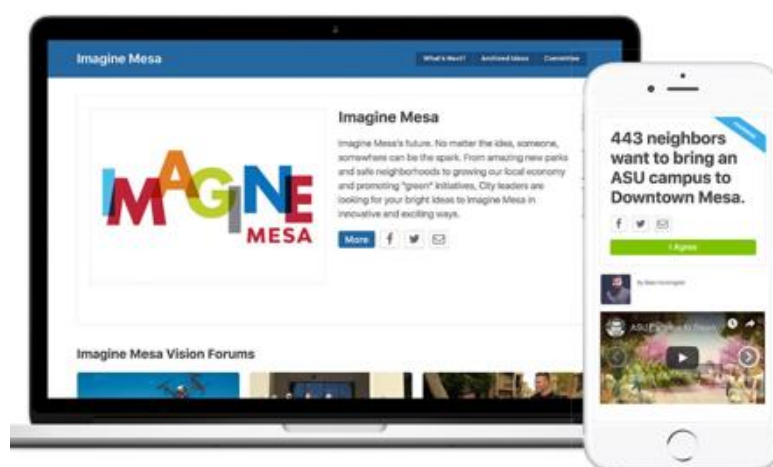


Figure 4: Neighborland digital platform

2.3.2 Smart Devices

For the smart devices field, researchers use infrastructure and IoTs mainly to deal with two kinds of relationships: community members and the government, and community internal connection.

Mahyar created communityPulse for scaffolding community input through text analysis and visualization.[11] She also created CommunityClick which is a smart device to capture attendee's real-time feedbacks in community meeting.[12] ConsensUs project is a platform to highlight agreements and disagreements when doing difficult group projects to help group members to understand others and reach a common ground.[13] MyPosition is a poll visualization for citizens to walk by and give opinion by selecting agreement or disagreement on one public issue.[14] Those tools aim to enhance the relationship between community members and government, and increasing mutual understanding. They focus on how to reach consensus for all stakeholders, offering a platform for all stakeholders to comment and speak up their voices. Then analyze those comments and feedbacks and visualize the results.

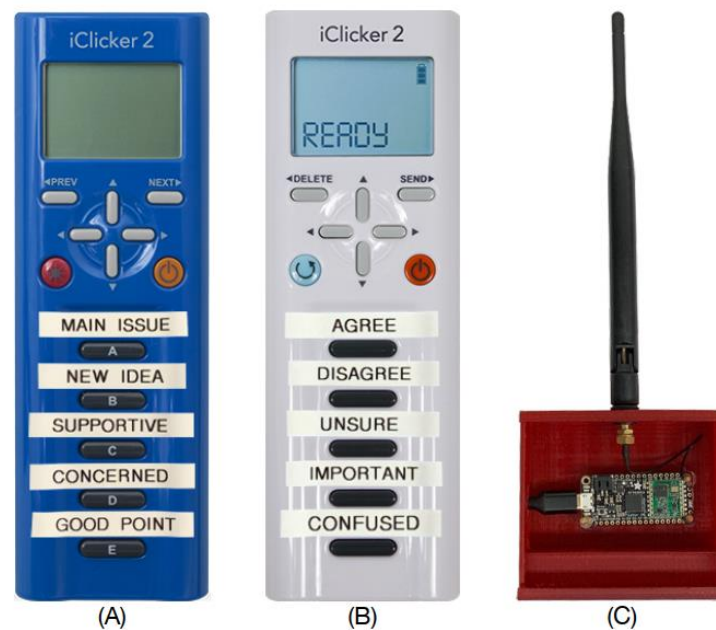


Figure 5: CommunityClick

Others concentrate on improving the connection within neighborhoods or establish entertainment installation for communities. For example, shareBox is designed for indirect resource exchange in local community. Community members can put items that they don't use in the box to exchange items from other community members. [15]Long creates a set of co-creative installations for public places.[16] For example, sound happening is a space where participants can create music collaboratively by levitating different balls at the same time. The shape of story is for participants to take turns on creating one sentence of the story, so that a story is co-created by participants line-by-line.



Figure 6: CommunityClick

The research trend from digital platforms to tangible media indicates the technology development in recent years. It also demonstrate that some downsides of digital platforms can be remedied by tangible media, which is one of my research hypotheses. According to the interview conducted by Christopher Le Dantec, government officials in Atlanta pointed out that the social media failed to reach out some groups of people because not all community members followed their social media account. In that case,

public issues can not be disseminated to all citizens. On the contrary, the tangible media that doesn't rely on social media or websites can eliminate this downside. Because of the physical presence, tangible media, in other words, smart devices can reach out to the groups that don't follow government social media account or the groups who don't have smart phones and laptops. The smart devices can inform people as long as they encounter the device.

Secondly, compared to the digital media, smart devices can better connect community members whose location identify unifies them together. As mentioned previously in the design principles, location is an important factor when design community related projects. Smart devices, whose physical presence has the strong relation of location, can perform better than digital media in enhancing community internal relationships.

3. Method

3.1 Human-Centered Research

To design a new system with community members that reflect their concerns and choices, and fulfill their needs and goals, I will reach out to community members and conduct a human-centered research with them. In this project, I will work closely with community-members through workshops, speed dating and survey methods. The workshop will contain survey and speed dating section. The survey section will ask the participant to fill the questionnaire about their current understanding of public algorithms.

Speed dating is a human-centered method created by John Zimmerman and Jodi Forlizzi.[10] It has two general methods: storyboard and user enactment. In this project, I will use storyboards to quickly show my ideas and seek for participants feedbacks. Instead of creating the high fidelity prototypes for all the ideas with high cost of time and effort, speed dating help me to create the scenario for participants to understand my design ideas by simply drawing the storyboards. It makes my design ideas understandable with low cost.

3.2 Participants Recruitment

I recruited participants through online and on-site to make sure to reach out as many potential participants as possible. For the online channels, I used Nextdoor, Facebook, Craigslist. Because those social media have neighborhood groups to make sure that the participants are Pittsburgh residents. For the on-site recruitment, I posted 30 flyers in the North Oakland and Shadyside neighborhoods because based on the IRB I have to conduct workshops at campus. Therefore, the neighborhoods which are near school is the optimal option. Below are some images that shows the flyer and the post on the social media.

And during the recruitment, I asked the participants to fill the form to gain basic

demographic information such as the race, gender, age, and the duration they have been living in Pittsburgh. This information will be used and analyzed in the next chapter. I will find the relation of demographic information and the individual's concerns and insights. This research is community-based participatory design. Thus it is crucial to include people from different culture backgrounds and ages. At the end, I have recruited 17 people, two people did not show up in the workshop. The are three workshops took place in CMU campus at Wean Hall and Porter Hall and an online session for people who are not able to meet in person. The online session had five participants. And the each in-person session had three or four participants



Figure 7: Participant Recruitment Flyer

3.3 Consent

Before the workshop begin, the participant are required to go through the consent form

and sign their names on the form. I will keep their identity confidential. I will gain their agreement to record the whole workshop sessions and take notes of their comments and reactions.

3.4 Workshop Protocol

To understand community members' desire and needs I will conduct several co-creative workshop, where I will encourage community members to write and draw their ideal way to be informed about public algorithms.

3.4.1 Introduction

The workshop will begin with the introduction part, which will last for about 10 minutes. I will firstly open with some reports on public algorithms, showing that the invisible algorithms had a deep impact on our citizens lives. Therefore, it is importance for community members to understand those AI based decision making tools and engage in the whole lifecycle of public algorithms. For example, 40,000 Michigan citizens have been falsely charged thousands because of unemployment fraud made by algorithms of Michigan Unemployment Insurance Agency.[1] In New York, small food businesses struggled to survive from screen algorithms made by U.S, department of Agriculture because of dubious fraud charges.[2] The error rate of algorithms and the potential problem of bias are harmful for public interests and rights, which call on action from community members.

Then I will ask the participants about their current understanding of public algorithms. Participants will answer following questions:

1. Are you familiar with any AI or “algorithms” being used in the public sector or by the government?
2. Have you ever interacted with or been impacted by any AI tools being used in Pittsburgh?
3. If yes, what was your experience? (Try to understand participants' attitudes and

potential asks for those systems)

After conducting the survey, I will introduce definition of public algorithms, the operation principle of public algorithms and the implementation of Allegheny County's public algorithms.

3.4.2 Presenting Examples

I will present some examples to inspire community members for the co-create ideal method for informing public algorithms. Participants can leave comments on those works and feedback prompts can be "I like...", "I wish...", and "What if...?" To test my hypotheses that tangible media may be more effective than digital website or social media in informing the public and could reach out to more people. So the examples are comprise of a website introducing public algorithm in New York and three tangible media I created as comparison. This session will last for about 20 minutes.

Website example:

At first, I will introduce Automating NYC [24], a website introducing public algorithms that being used in New York City to citizens, including library, education and housing service. This website is created as master thesis from four students from Harvard. It helps the citizens to learn the five aspects of the algorithms: impact, bias, explainability, automation and flexibility. I will collect the participants' feedback on whether this website is attractive for them to read compared to tangible media and also whether it is comprehensive in content. This website example plays a role as the background and the comparison of the following tangible examples that I created.

Tangible example:

The following three examples are created by myself. They are aim to test the second hypotheses of my research on what will intrigue community members to learn the algorithms. The three examples varies from sites, ways of interaction, and inclination

etc. Two of them are shown in storyboard. One is an IoT prototype, which the participants can play with. Those three examples are as the following:

T1: Alice is waiting for a bus at a bus stop. The bus will come in 10 min according to the schedule. A screen near Alice “speaks” to her, asking if she would like to learn about ways algorithms are being used in Pittsburgh. Alice decides to learn more, to pass the time. She says “yes”, and the screen shows her three uses of algorithms in Pittsburgh that affect this neighborhood. Alice selects “child maltreatment risk prediction”. The screen offers her several options about the “Allegheny Family Screening Tool” (AFST), the AI system being used to help predict child maltreatment, for Alice to read.

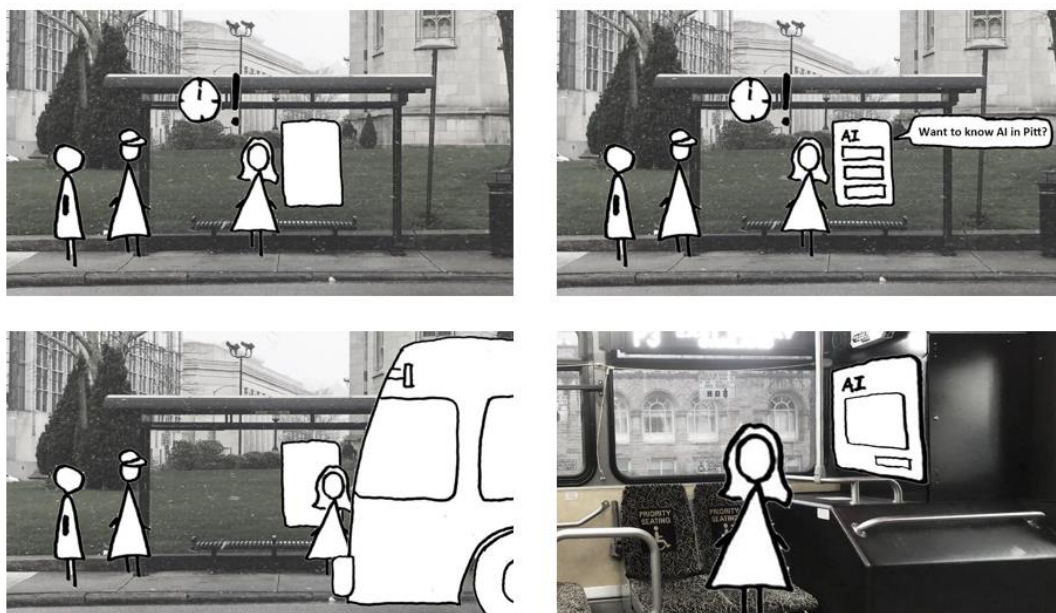


Figure 8: Storyboard 1

This storyboard is to test the factor of site and time. Because the avatar is waiting for something, which will increase the chance they will play with the screen. Another point of this storyboard is creating the media that could continue the learning experience through multiple spaces.

T2: James notices that there are several small robots running in front of his house at Bloomfield, causing inconveniences. He isn't sure of the purpose of these robots and

sometimes they block his driveway, which makes him late to work. When James walks close to the robot, the robot greets him. James starts to ask the robot what its purpose is and shares his concerns about blocking the driveway. James learns that the robots are from a robot delivery company. The robots help deliver food and covid tests for people in need.

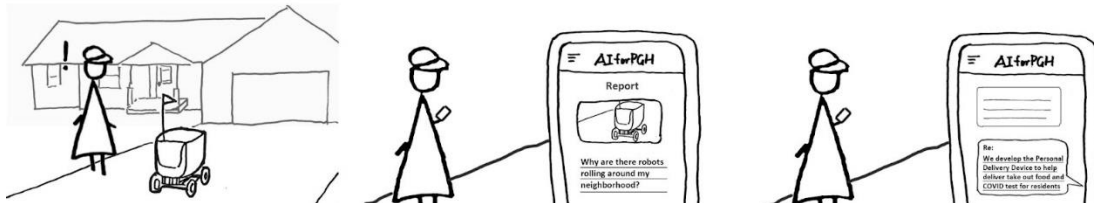


Figure 9: Storyboard 2

Compared to the previous storyboard, the informing part is intrigued by an annoying incident happens and the avatar has to passively learn about the public-facing AI. But the first storyboard is that the avatar intuitively wants to explore the public algorithm. I would like to collect feedback from community members about what motivates them to engage in the public issues. I'd like to discuss whether is interest or their experience.

T3: The third example is Tangible Poster, an IoT project advised by Professor Nikolas Martelaro in CMU HCII. This tangible Poster is to create poster templates using Internet of Things (IoT) technology to collect public attitudes about delivery robots implemented in neighborhoods. Instead of using a more commonly-used but often expensive LED screen, I proposed and implemented a more affordable tangible poster with an Arduino GSM module combined with LED lights. This prototype can fit multiple topics on robots and can be reproduced easily and at a low cost by community members with low tech-savviness.

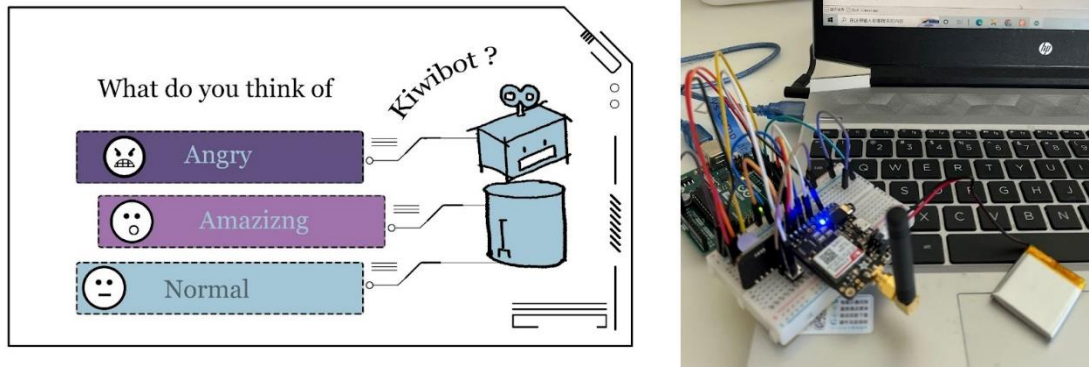


Figure 10: Tangible Poster

This IoT is aim to show instant feedback and view others' opinion at the same time. Through this process, I'd like to explore what kind of interaction way could attract community members and avoid display blindness.

3.4.3 Design Activity

Participants will be divided into group of three in 20-minute session. Based on the initial solutions they created in step one and technologies they learned in step two, participants will pick 1~3 scenarios that interest them, and draw or build prototypes. A toolkit will be provided, containing card deck representing some technologies or even basic Arduino modules, if this workshop will have several sessions. From step 2, we can offer them toolkits about technical modules that they can rely on in this step.

3.4.4 Presentation

In the end, the participants are required to present their design and share their ideas with others. And we will discuss the following questions: why you choose this approach. If it is an installation, where will you put it? What content or aspect of algorithms do you want to include in your design?

4. Data Analysis

4.1 Participants Demography

The workshop planned to have 12 people in four sessions. In the end, 11 participants show up in online or in-person sessions. Before the workshop, I asked the participants to fill the form to get the demographic information. In the form, the participants are asked their gender, race, the duration they have lived in the Pittsburgh and the neighborhood they have been lived. All the information in the thesis is anonymous.

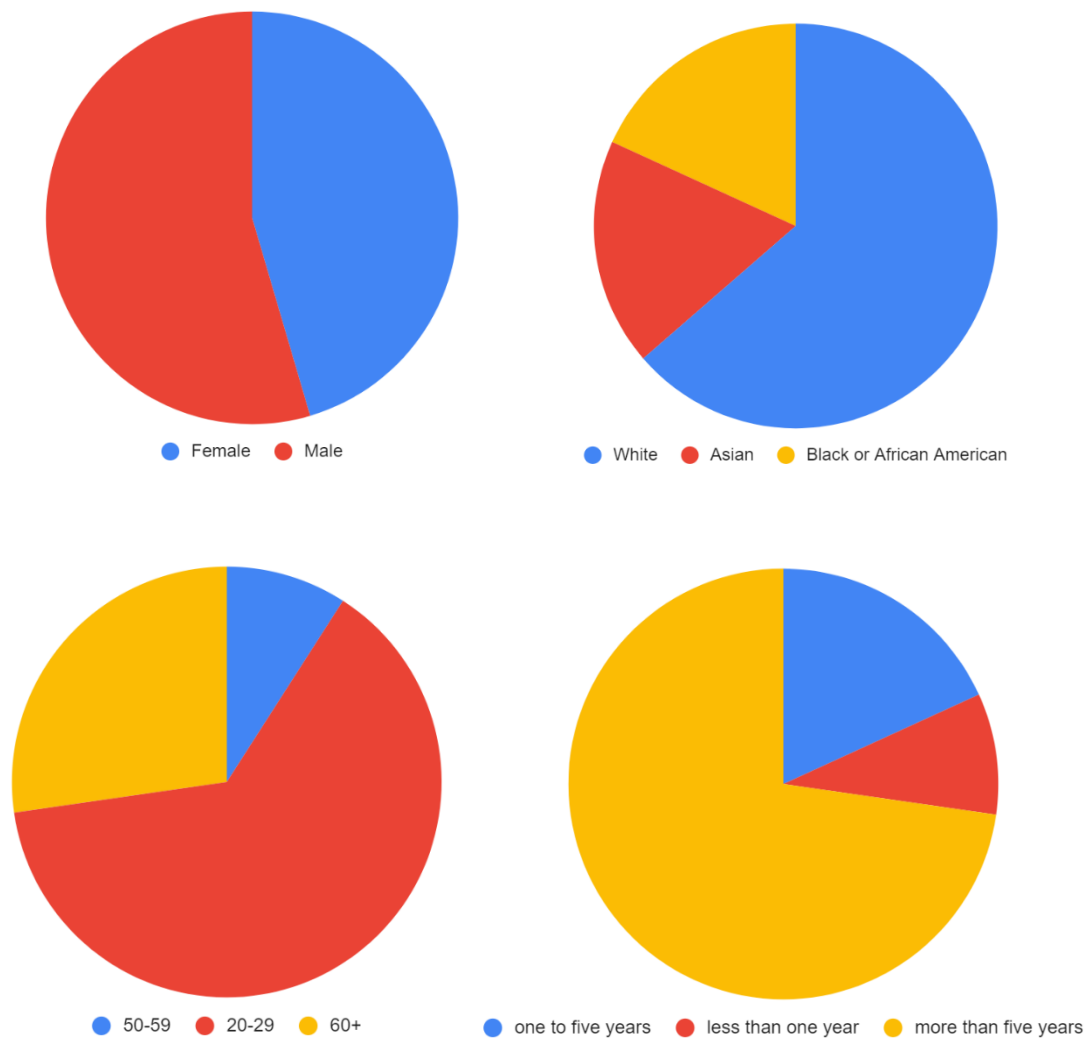


Figure 11: Participants Demographic Information

In order to make the workshops inclusion and equity, I balance the race, gender and age of the participants. I want to make sure people from different groups have the equal chance to be considered in the decision-making process. As shown in Figure 11, there are five females and six males participating in the workshops. The participants are different races—white, Asian, and Black or African American. Due to IRB, the participants' ages should be above 16. The participants are from different age clusters from 20 to 60+. To be more specific, there are 7 participants aged 20-30, one participant aged 50-60 and 3 participants aged 60+.

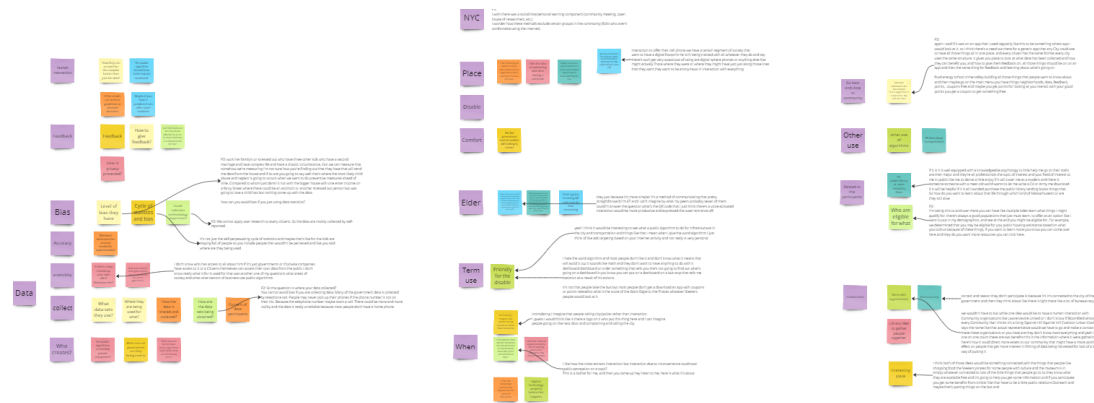
For the duration that the participants have lived in Pittsburgh, the majority have lived in Pittsburgh more than five years. This ensures that most of the participants have deep understanding of their neighborhoods and community cultures. On the other hand, in the study of understanding communities attitudes of public algorithms, the newly community members should also be included. Hence, I recruited 2 participants who have lived in Pittsburgh 1~4 years and one participants lived in Pittsburgh less one year. The diversity of the duration of living makes sure that people from different groups have the same opportunity to share their ideas.

The neighborhoods where participants live also varied. Some are from Friendship, Hazelwood, Regent Square and Greenfield, which are far away from CMU campus. Others are from Squirrel Hill and Shadyside which are close to CMU campus. The neighborhoods are scattered throughout the city.

4.2 Affinity Diagram

I will use affinity diagram, a user experience method, to analyze the data I collected in the workshops. Affinity diagram is a method for quantity analysis. Through this method, the transcripts of the workshop or the interview are cut into several pieces of notes. And then the notes will be clustered based on the similar contents or aspects. The notes are categorized and hierarchized.

In this research, I firstly wrote the transcripts for each workshop session and turn them into pieces of information. In addition, the artifacts, notes and drawings, created by the participants are also cut into different pieces of information based on the contents.



The notes wrote by the participants are from the discussion sessions in workshops. In the workshop, participants are required to write down their opinions on the sticky notes and then post it on the poster. There are two discussion sessions in each workshop. One is what aspect of public algorithms would like to learn. Another discuss sessions is about getting the feedbacks from the storyboards and the tangible poster that I created.

Moreover, the drawing artifacts are from the co-design session, which is the final part of the workshop. In this session, participants are required to draw and write down their ideal way of being informed of public algorithms. Those two kind of artifacts, drawing and the notes, are also considered in the data analysis part.

4.3 Findings

Through the three sections of the workshop: introduction, inspiration and co-design, the participants have discussed about the contents and methods they would like to learn about public algorithms. I began with social reports about public algorithms and asked the participants their current knowledge of them. Only two out of eleven

participants said that they have knew public algorithms. But neither of them is familiar with public algorithms. The overall understanding of public algorithms is scarce. There is an urgent need for community members to learn about public algorithms, which may have potential influence on them. Following are findings from the workshops. I divided the findings into three parts: display contents, design feedbacks and co-design ideal ways.

4.3.1 Contents that should be Showed on the Public Display

To ensure the public display are helpful for citizens, it is crucial to learn from citizens what information they would like to know from the display, and what aspects they care most about.



In this section, I introduced what is the public algorithm, and why it matters to participants. I also presented some aspects to measure the quality of the public algorithm. Then I asked the participants to write down what aspect of public algorithms they care most and we had discussions in groups. The findings could be suggestion to guide what content should be shown on the public displays.

a. Data Collection and Usage

Due to the essence of public algorithms, it is inevitable to use large amount of data. Data is also the most concerned part of public algorithms for the participants, including the how the data was collected, the data usage, and the accessibility of the data sets. To inform the citizens of public algorithms, the public display or the digital platforms should describe the data collection and usage clearly to build trust from citizens.

Participants wondered whether the government get the consents from the citizens when they collect the personal data, and also through which methods the data sets are being obtained. They would like to make sure that the data collection is under legal and transparent method. They also mentioned their concerns that bias could occur in the data collection process. One participants questioned the method of making phone calls to get household data could lead to data nullity. "So the question is where your data collected? You cannot avoid bias if you are collecting data. Many of the government data is collected by telephone call. People may never pick up their phones if the phone number is not on their list. Because the telephone number maybe a scam call. There could be more and more nullity and the data is really unreliable because most people don't have a home phone."(P2) Another participants pointed out the cycle of statistics and bias. Statistics is the beginning of AI model building. If at this stage, we don't include every citizens, it could lead to exclusion and bias in the whole algorithms. "It's not just the self-perpetuating cycle of statistics and maybe that's like for the kids are staying full of people so you should include people that wouldn't be perceived"(P1) One of the participants assumed a more concrete scenario about the data bias that could occur in the Allegheny Housing Assessment. "her family is stressed out who have three other kids or who have a second marriage and have complex life and have a chaotic circumstance. Can we can measure it? If you are going to say well that's where the most likely child abuse

and neglect is going to occurs ahead of time. Compared to whom just damn it not with the bigger house with one enter income on a fancy Street where there could be an alcoholic or another stressed out person but was going to lose a child. But nothing come up with the data.”(P3) The government should make efforts to avoid bias and show the process to the public.

“Who else besides local government has access to/can use public algorithms? Is there a way to look up your own data and is there a way to look up someone else’s data?”(P6). Participants are worried about the data accessibility, because if other private companies or other individuals have access to the public data, how to monitor the data is used in a good way remains a question. Secondly, privacy issues also related to the data accessibility. With the data accessibility, the data should be under protection. On the other hand, if only the government has the access to all the data, how to make the data transparent to the public. Currently, Allegheny county provide the public with the general overlook annually. And also with the official data request procedure, the researchers or other non-profit organization can access the data for academic or social good use. This information about data accessibility and transparency that participants care should be showed on the public display and get citizens informed.

b. Feedback Mechanism

Participants also care about Feedback mechanism and human intervention. They concerned about the accuracy of public algorithms when dealing with complex issues. “The public algorithm should have some human sentiment. Maybe if you have a problem made by the public algorithms it can offer some solutions.”(P11)

Participants were curious about If the results are used as guidelines or absolute decisions. Participants would like to know if the public algorithms make the wrong prediction or decision, human could intervene in the decision making process and make the right choice.

In addition, participants showed the needs for the feedback mechanisms. “Are there avenues for individuals affected by a P.A. to share feedback in a standardized format?”(P2) This also shed a light on the design of public display. Public displays or digital platforms could not only serve as showcase platform but also as a feedback collecting and dealing platform. For example, in the inspiration part, I also designed the Pittsburgh AI platform to help residents to learn about public algorithms. And on this platform, residents can also send their complains and feedbacks to the city officials and they expected to get the reply in one week.

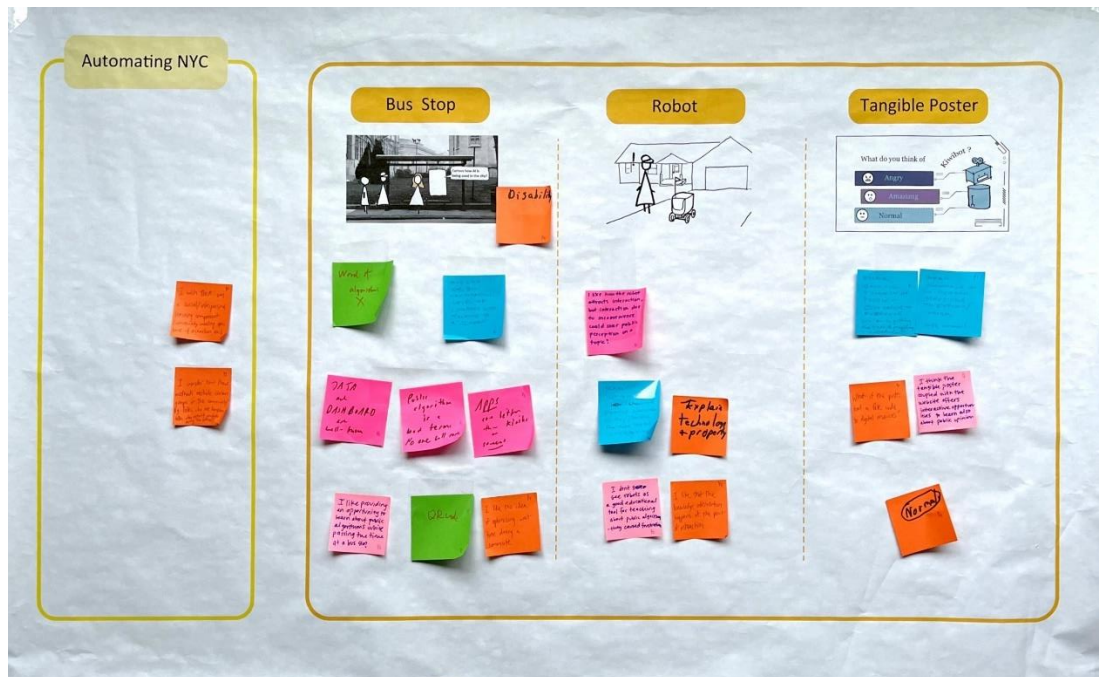
c. Who created the public algorithm

Who created the public algorithm is another question that participants would like to know. And also which area of government are public algorithms being used. Three out of eleven participants write these comments on the poster. Participants showed interest in the internal power structure and responsibility of the government. They would like to know if the public algorithms is created by the government or a third party organization. With this information, they can tell who take the actual responsibility of the public algorithms. If the public algorithms are created by private companies, the question remains in the participants minds that the user data is not used for commercial use. This information should also be transparent and showcased on the public displays and digital platforms.

4.3.2 Design Feedbacks

In the inspiration section of the workshop, I presented three tangible designs to participants compared to the digital website created by others. It is to test my previous hypotheses that tangible media may be more influential than digital website or social media in informing the public could reach out to more people. For the comparison of my three tangible design ideas, I would like to test the method, place

and time to inform citizens of public algorithms. I presented the digital website example first and then the tangible design ideas. At the end of the section, participants wrote down their opinions on the sticky notes and shared their thoughts together.



a. Tangible V.S. Digital

Participants confirmed my hypotheses on tangible vs. digital that people prefer some physical objects to learn about public algorithms. And the digital media has limitation to reach out to more citizens “I wish there was a social/interpersonal learning component (community meeting, open house of researchers, etc.) I wonder how these methods exclude certain groups in the community (folks who aren’t comfortable using the Internet).”

b. Feedbacks on Interactive Screen Design

1) Place to put public installations

Most participants like the idea of using the time of waiting the bus to learn about public algorithms, which indicates where to put the co-creative installation. “I like providing an opportunity to learn about public algorithms while passing time at a bus stop.”(P5) “I like the idea of optimizing wait time during a commute”(P6)” Okay, in a

public place example in a bus stop people would watch while waiting for bus”(P10)

Those comments from participants suggest that the people would like to learn public algorithms during the waiting time. This is not limited to bus stop. For example, the introduction of Allegheny County Hello Baby algorithm which is about new born children’s welfare could be placed in the waiting area of hospitals. In that way, when families go to hospital for pregnancy check-ups, they can have a chance to learn about this algorithm.

But for the idea of continuing learning on a carry-on smart devices, participants showed negative perspectives. It makes the residents think they are being tracked and worried about the privacy issues. “This interaction on their cell phone presents that we have a certain segment of society that want to have a digital footprint. It feels like that he is being tracked with all whatever they do and say. There's such get very suspicious of using are digital sphere phones or anything else that might actually trace where they were or where they might have.”(P8) In this way, I think the carry-on idea should be revised.

2) Talking as a Interaction Method

The screen on the bus stop is interacted by talking. Participants hold multiple perspectives on this interaction method in public places. On the one hand, this design idea is friendly for the marginalized people. Because talking is a good method for some disabled people. In addition, compared to the QR code in the robot design, talking is a easy way for who are not familiar with cell phones.

But we should be careful when design a installation which interaction method is talking. Some people might feel uncomfortable and also privacy issues need to be considered. “OK, But generational level of comfort with talking to screen should be considered.”(P1)

c. Feedbacks on Interactive Robot Design

The interactive robot is a very proactive design idea, because it happens when the public algorithms have caused some trouble for the residents. This design is also aimed to test the feedbacks on cell phone apps to learn about public algorithms.

1) QR Code is inconvenient for some groups of people

“Older people will not be in a position to interact with robots. It will mostly favor the younger generation which will be kind of unfair to the old generation. If there's something that can favor both parties I think it will be better.” (P8) “Yeah I guess scanning QR code may be time consuming.”(P11) Participants showed their concerns that downloading the app to know more is hard for people who are not familiar with cell phones. And one participants brought up one solution for this problem. “Maybe if the inaction with a robot would be something along the lines of Siri- a lot of older residents are not technologically savvy to work with QR codes and use the smart phone to it full use.”(P8)

2) The use of the term “algorithm”

Many participants expressed that the term of algorithm is hard for them to understand what the decision-making tool is about and make them feel scared. They thought that dashboard is a better term to use. “I hate the word algorithm and most people don't like it and don't know what it means that will avoid it because it sounds like math and they don't want to have anything to do with it dashboard.”(P3) “when I give the word algorithm I just think of like ads targeting based on your internet activity and not really is very personal”(P6)

3) When to get informed of public algorithms

Participants thinks that learn public algorithms in a situation where robots caused trouble will soar public perception. The robot design idea shows that it is not a good time for residents to learn about the public algorithm when they get troubled by it.

“Intimidating I imagine that people calling city/police rather than interaction. I guess I would think like is there a logo on it who put this thing here and I can imagine people going on like next door and complaining and calling the city.”(P1) “This is a bother for me, and then a robot came up, saying ‘hey! listen to me, here is what it’s about’”. Instead, Learn the general of public algorithms ahead of time and get the specific information when facing the actual situation is the optimal method. “I like the knowledge intervention happens at the point of interaction”(P5) “Explain technology property before that happens”(P4)

d. Feedbacks on Tangible Poster Design

The tangible poster is the design that participants like most, because it is simple and attractive. “Have you ever sees the buttons and say sad red or green smile or frown at a restroom in an airport asking feedbacks for bathroom cleaning? I'm seeing a hundred people press that button on the way out of the bathroom just because they want to give feedback usually a snapped something simple to get people involved.”(P3)

Participants also mentioned that if they could learn and give feedbacks with a more broad context, and that will be better. “I think the poster coupled with website offers interactive opportunities to learn also about public opinion.”(P5)

4.3.3 Co-design Ideal Ways to be informed of Public Algorithms

1) Collaboration with Community Organizations

Participants explained that the low interest in the citizen’s engagement on public algorithms is because citizens don’t trust government enough. “The reason they don't participate is because it's it's connected to the city of the government and then they think about like there is a lot of bureaucracy.” (P10) To remedy the relationship

between citizens and government is to plug in existing community organizations and other institutions that have a better connection with community members.

Participants ideated that some organizations that could cooperate with informing community members of public algorithms. For example, museums that could display art installation to inform people of currently implemented public algorithms. Libraries can have interactive screen for community members to learn about AI decision-making tools. The rationale behind the collaboration is to find public place that can gather different groups of people due to their interests. "I have a simple idea of plugging into existing community groups and interpersonal connectivity. There's a bunch of neighborhood associations or maybe religious or other groups of people are people congregate and people trust. I thought there's an opportunity for intervention where researchers are other government leaders come in and talk to people the community about these things before they happen. "Utilize public libraries. They are free, accessible and a place where community memebrs of all backgrounds go to learn. Librarians are knowledgeable about resources in the communities. They are help provide that interpersonal connect or human touch for anyone struggling with questions. Librarians at CLP are unionized and can use their collective power to help advocate for things they are hearing from the public. Hosing free events where officials and data scientists are guest speakers."(P6)

Method: Utilize public libraries. They are free, accessible, and a place where community members of all backgrounds go to learn. Librarians are knowledgeable about resources in their communities. They can help provide that interpersonal connection or "human touch" for anyone struggling with questions or concerns. Librarians at CLP are unionized and can use their collective power to help advocate for things they are hearing from the public

Content: hosting free events where officials and data scientists are guest speakers
have a childrens section specifically with books and resources

In addition, participants also suggested that traditional ways of community meeting, government agency and town hall can also reach out to community members and help them get informed of public algorithms. Community representatives or organizers can directly talk to community members about the general information about public algorithms. Participants believed that the traditional method can also include community members as much as possible. "I thought for all these interacting in a public space like physically outside of your home. I'm sure we won't inform all segments of society about these algorithms. I was just thinking of maybe how that might exclude maybe people are home. or maybe I don't want to stereotype it may be older folks who aren't as comfortable with the Internet or interacting with digital media like how they might become isolated, not understand how this is shaping the community."(P5) "Human interaction with Community organizations like Lawrenceville United or like I am living in Squirrel Hill, we have Squirrel Hill Coalition Urban Coalition. The actual representative that we have to go and make a contact with these organizations. It could direct more assets to our community that might have a more positive effect on people that get more interest."(P8)

method: community meeting tour + art installation & talk
↳ also online option
} who: w/ officials & public data scientists
↳ maybe participation incentive?

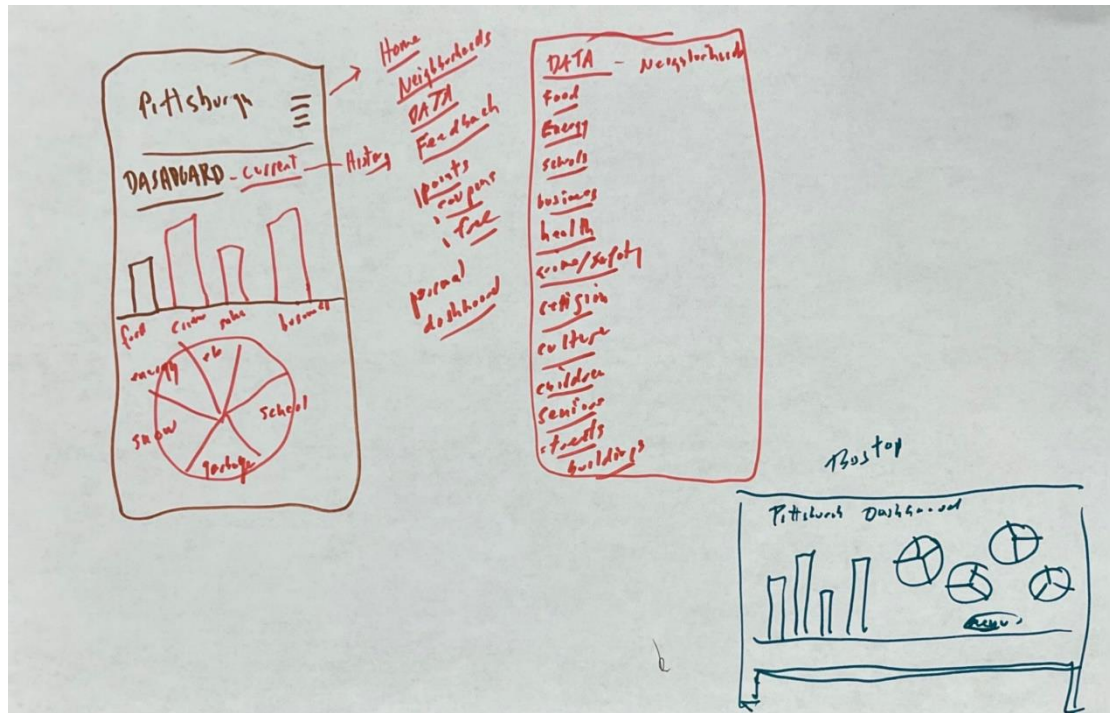
content: what are public algorithms?
who has access?
why are they used?
how is data collected?
when and how will they be implemented?

Government agencies can also present some promotional videos to citizens. For example, when citizens are waiting at department of motor vehicle, they can watch some promotional videos about public algorithms implemented on city's transportation.

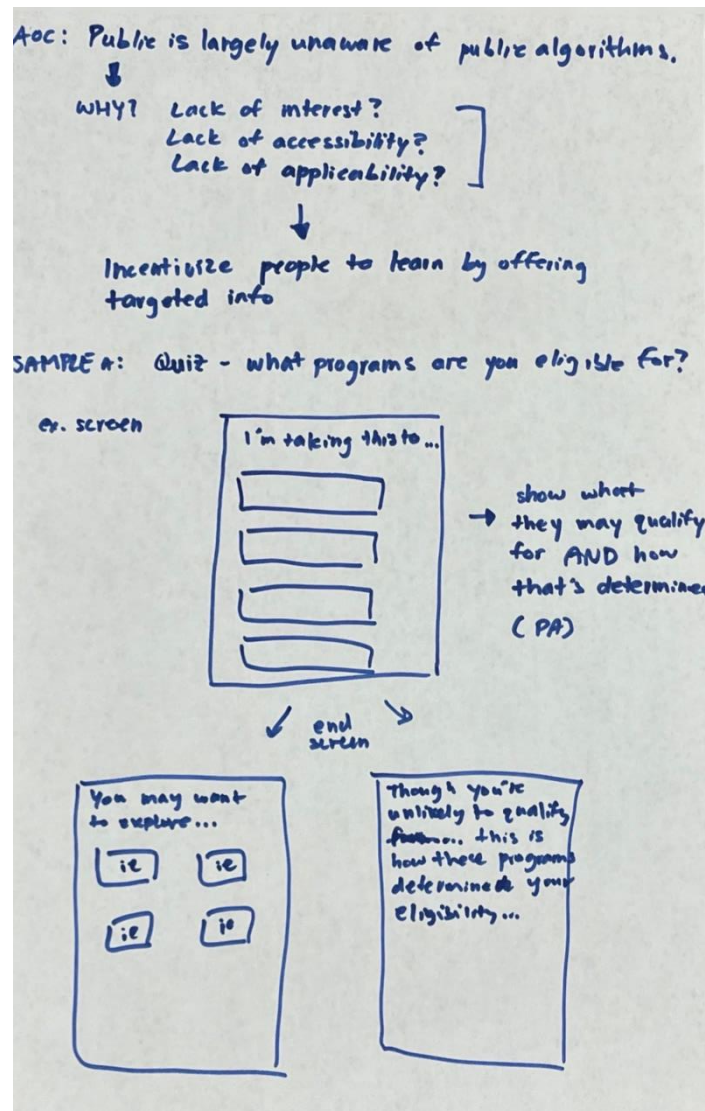
To conclude, inform community members about public algorithms is not only about tangible installation in neighborhoods, but also an activity that requires engagement for all sectors from society.

2) Personalize the Interface

Participants suggested that integrate all the information about public algorithms and other policies that related to citizens' lives on one platform. And this platform can give individual suggestion on which public algorithm to learn due to their interest.



The participant named the platform he designed as Dashboard for Pittsburgh, which as shown in the figure above. The Dashboard for Pittsburgh contains all things about city life. Community members can get benefits if they engage in the AI decision making process. For example, they can get some coupons for grocery stores. In this way, community members would be encouraged and motivated in the engagement process. "if it was on an app that others app I used regularly, I would look at it. I think there's a need out there for a generic app that any city could use to have all those things, all in one place. And every city has the same format and uses the same structure. It gives you a place to look at what data has been collected and how they can benefit you, and how to give them feedback on. All those things should be on on an app and then the same thing for feedback and learning about what's going on, such as food, energy, school crime safety building all those things that people want to know about. and then maybe go on the main menu you have things neighborhoods, data, feedback, points, coupons free and maybe you get points for looking at you interact with your good points you get a coupon to get something free."



Based on the idea of Dashboard for Pittsburgh, some participants add the suggestion feature that personalize due to individuals' interests. This is because participants expressed that things related to themselves would increase their motivation to learn about public algorithms. For example, one participants who is a student at school, said he would be interested in the public algorithms implemented in public libraries. "I'm a student. And it will be helpful if it is about the public library lending books things like the public algorithms implemented in Massachusetts"(P7) According to this finding, participants design a more personalized interface as show above. "To offer as an option that I want to put in my demographics, and see at the end you might be eligible for. For example, we determined that you may be eligible for you public

housing assistance based on what you told us because of these things, if you want to learn more you know you can come over here and they do you want more resources you can click here.”(P2)

5. Conclusion

Public algorithms effect citizen's lives tremendously. Community members have the right to get informed of these AI decision making tools. But currently the public understanding of them remains scarce. Due to this situation, I brought up my research question that about How to impactfully inform community members of public algorithms? My long term goal is to build the whole life cycle of AI decision-making tools: designing, developing, and overseeing). And the first step is to help community members to realize the occurrence and importance of public algorithms, which is to inform them of public algorithms. From the literature review, I noticed that most research is about communication and participation in the real world issue like city planning or infrastructure, but there are few discussions on the engagement in complex AI decision making process, which accounts for the importance of my research. I scope down my research question into two parts: What kind of aspect do they want to know about public algorithm? and compared to digital platforms can tangible installations inform more community members?

I used workshop, a human centered research method to co-create platforms to inform community members of public algorithms. I conducted four workshop sessions with 11 community members. In order to make the workshops inclusion and equity, I balance the race, gender and age of the participants, as the figure shows. I created three tangible media designs to test my tangible versus digital hypothesis. And if tangible media is better, what location and way of interaction is optimal for community members.

From the workshops, I found that data, feedback mechanism and who created are the three aspects that participants cared most. This information should be displayed on the public installations. Participants confirmed that people prefer some physical objects to learn about public algorithms. And the digital media has limitation to reach out some groups of people. For the tangible media design, participants have offered

various feedbacks. The term of algorithm or AI is hard for participants to know what the decision-making tool is about and decrease their willingness to learn. Instead, the term can be revised as "dashboard". Learn public algorithms when something unpleasant happens will soar public perception. Instead, learn general things ahead of time and get the specific information when facing the actual situation. In addition, compared to QR code, talking is friendly for some people (disabled or unfamiliar with cell phones). Last but not least, community members prefer simple interaction methods such as clicking buttons to give feedbacks. And when the public display is shown, it's better to give the context and resources for people to learn more. In the co-design session, participants also presented their ideas to be informed of public algorithms. Firstly, we can collaborate with community organizations or public institutions. For example, museums that could display art installation to inform people of currently implemented public algorithms. Libraries can have interactive screen for community members to learn about AI decision-making tools. We can also use traditional method to inform community members. Community representatives or organizers can directly talk to community members about the general information about public algorithms. Secondly, participants designed a dashboard that integrate all the information on one platform and give individual suggestion due to their interests and backgrounds. This personalized platform can inform citizens better about public algorithms that related to their lives and benefits them more.

This research helps citizens to perceive and understand public algorithms to empower them to engage in the further AI decision-making process. I also find impactful methods to inform people of public issues and understand which aspect of public algorithms citizens care about. So that in the future, government officials and developers can pay more attention on this aspect.

6. Limitation and Future Work

This research has several limitations using human-centered research method. First of all, the workshop emphasis on the public algorithms implemented in Allegheny County. They are in the area of assigning rapid houses to homeless people and predict the risk of children abuse. Those areas are less related to participants' real lives. I should focus on the area of public algorithms where more close to participants, such as environment, safety and public libraries. Those algorithms are not created by Allegheny County, but by other cities and some non-profit organizations. Secondly, I held four workshop sessions and one of them are online for people who cannot attend in person. Compared to the in-person sessions, the online session had less interactions and discussions in the group activities and design thinking exercises. For the next time when I conduct workshops, I will avoid online sessions or do pilot study especially for online session to attract participants attention.

For the next step, I will create some prototypes such as the tangible poster and the Dashboard for Pittsburgh, based on the participants' feedbacks and co-design insights. I will also pursue the long term goal, to build the whole lifecycle of AI decision-making tools: designing, developing, and overseeing). in my PhD study at Georgia Tech.

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