Democratizing Design through Generative AI

Tatiana Lau
tatiana.lau@tri.global
Toyota Research Institute
Los Altos, California, USA

Scott Carter
scott.carter@tri.global
Toyota Research Institute
Los Altos, California, USA

Francine Chen
francine.chen@tri.global
Toyota Research Institute
Los Altos, California, USA

Brandon Huynh
brandon.huynh@tri.global
Toyota Research Institute
Los Altos, California, USA

Everlyne Kimani
everlyne.kimani@tri.global
Toyota Research Institute
Los Altos, California, USA

Matthew L. Lee
matt.lee@tri.global
Toyota Research Institute
Los Altos, California, USA

Kate Sieck
kate.sieck@tri.global
Toyota Research Institute
Los Altos, California, USA

Figure 1: Allowing the lay person to use generative AI to design and modify new spaces to be inclusive to others.

ABSTRACT

Conversations around public spaces are fractured and often circle around designs and their implications for the space. Contributing to this problem is the fact that people often talk past one another. Recent advances in generative AI may help to democratize this process of designing for public spaces and enable people to meaningfully converse with one another. Here, we develop a platform that asks users to submit a photo and story about a place in their community that they cherish. The system then pairs each user with a target person whose preferences conflict with their own preferences. Users read the target person's account and use our generative AI system to redesign a space to accommodate the target person. Preliminary studies demonstrate that the act of redesigning the space may lead to greater empathy for the target person, which may help advance conversations around public spaces.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in collaborative and social computing**; **Collaborative and social computing systems and tools**; • **Applied computing** → *Psychology*.

KEYWORDS

Design, Generative AI, Social connection, Multi-stakeholder systems

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1 INTRODUCTION

Discussions around public spaces and for whom and how they are designed can be contentious. One person's favorite public space may not be meeting the needs of others. How can multiple parties come to agree on something that satisfies everyone's needs and desires? Conflicts can be inadvertently amplified by the fact that people may not share similar representations of the same objects, and resolving these conflicts requires a degree of empathy and perspective-taking [9]. What if designing for others could enable not only a shared representation of concepts but also increased empathy for one another? We propose that new generative AI technologies can enable a paradigm of design in which users are not only involved in the design process but also actively involved in the *act of designing* itself [10, 13]. To realize this vision, we built a system for lay users to easily use generative AI to redesign their own community spaces and better connect and resolve questions about the impacts of modifying spaces. Using generative AI in this manner may help to democratize the conversations around redesigning public spaces.

While existing work has sought to build systems helping people to envision new possibilities, there seems to have been little allowing users to co-design with one another. Some recent efforts have built systems that help to morph our current physical neighborhoods into new visualizations of realities. For example, a website set up by the Netherlands' tourism board [14] helps users envision how adding cycling pathways in their towns might look. Another project [21] repaints one's local neighborhood into different styles (e.g., cyberpunk, psychedelic countryside, etc.). While one could argue that these tools lower the bar for users to generate new visualizations, these systems do not address a few key points that are crucial to democratizing the discussion around designing public spaces. First, they limit the agency of users by having preset designs (e.g., [14] is specifically aimed towards adding more cycling paths). Second, they do not necessarily seek to create dialogue in the user's community; users are mostly meant to use the system for their own pleasure rather than design for others or design to communicate with others. Thus, the resulting designs are not meant to spark broad conversation amongst users about the use of public spaces. Finally, these systems do not have an aim of creating more empathy amongst users with the goal of decreasing such interpersonal conflict. More accessible tools that lower the bar for users to create and visualize new possible states of the world may help them to feel more empathy for others. Such tools that lower the communicative burden and help users who otherwise may be unable to communicate their ideas can even the playing field in debates, particularly those that are place-based and require some degree of visualization and visual communication. Thus, generative AI tools that explicitly help users to design together may be well-served to fill this gap.

Additionally, in considering how to turn the design process into a dialogue between parties with different interests, we focused on empathy. Empathy, which is frequently defined as the ability to emotionally resonate and perspective-take with others, consistently serves as a communicative lubricant in our social world. It helps us to understand others' emotions and perspectives, and in so doing may activate prosocial behaviors and/or reduce conflict between parties [8]. In past studies, empathy is most frequently elicited by participants passively taking in other people's accounts, whether by reading about someone's life as a story, watching video, listening to other's accounts, or via virtual reality [2, 3, 7, 20, 22]. In other words, through communicating our own perspectives and accounts, we may be able to elicit empathy needed to deescalate conflict.

It is not surprising, then, that designers have sought to elicit empathy in many ways, whether through interactive story-telling or through moderated creative game design (e.g., [17], [4]). Other research has sought to understand how platforms and conversational agents can help to augment social movements by expanding documentation that could be shown to outsiders to elicit empathy [5]. Finally, recent work has sought to understand how particular, creative narrative designs may help to elicit greater understanding from readers [12].

Here, we sought to merge these ideas into one system that could potentially increase empathy and decrease conflict between members of a community by (1) encouraging users to understand a target person whose views are very different from their own and (2) asking users to visually redesign a 2D image to accommodate the target person's needs. Our system is novel in that it pairs people with users who are different from themselves and asks them to consider the other user's account and perspective not just through reading the account but also through using generative AI tools to design for them. These redesigns can then be sent to the target person for feedback, thus starting an asynchronous conversation about how to design a shared space. Our paper's second contribution is in our experimental study, where we test the idea that designing for another person can potentially increase feelings of empathy for that person.

2 SYSTEM DESIGN

Our system follows a series of generalizable steps.

(1) **Upload**: Users first are asked to upload a photo of a place in their community. They are asked to provide a type of place (e.g., welcoming or safe) in their community. They then provide a "story" about the photo and place. Specifically, users in this instance are asked to (a) provide open-ended text characterizing the contents of the photo, (b) state why they chose to submit this place, and (c) state how they might modify the space for someone who felt excluded in that same space.
The questions to elicit the story can be modified to fit with the particular goals of a given instance of the system (e.g., users could share photos of things that represent significant parts of their lives), but the story overall is important for the system to implement the next step.

(2) **Match and Read**: Our system compares story text embeddings to pair new users with a target person in our story bank whose views and experiences are opposed to the user's. This story bank is a collection of stories we collect before running the study following the same procedure as step 1. The system generates embeddings of each story text [16], and clusters them into place clusters such that stories about similar places (e.g., parks) are grouped together. To match a new user with a target person, the system embeds the user's story, identifies the place cluster that the story is most similar

Figure 2: (left) Our simple web-based sketching tool to indicate a region to edit with a supplied text prompt ('ev charging station'). (right) An example generated image showing the first of two options.

to, and then identifies another story within this cluster that is the greatest distance from the user's story, resulting in a matching pair of users with opposing opinions about similar places. In this instance, our system only seeks one target person, but the system can match the user with more than one person. For example, it may be better to strategically show fewer different stories (i.e., stories of shorter distances) of other people before showing the story of the target person vastly different from the user. After being matched, users see this target person's photo and read the accompanying story.

(3) **Design Task**: Users use generative AI to redesign the photo of the space that they originally uploaded or a space in a photo provided by the researchers. The provided photo may reflect a generic open space or a type of place that is similar to their initial uploaded photo. Specifically, users make the space more inclusive for the target person by sketching a mask of the area in the image to modify and adding a text prompt with instructions on how to modify the image. The interface also asks users to describe why they have chosen to edit the photo this way. The prompt is sent to a remote server, which attempts to generate the images. We used a configurable set of models that generate a preset number of images and allow the user to select the option that best matches what they had envisioned (Figure 2). As generative models can sometimes produce unreliable or poor results, this approach increases the likelihood of producing a usable image by novice users of generative AI. This approach also provides more flexibility to experiment rapidly with different models. We configured our system to work with proprietary APIs, third-party open-source models installed on machines we control, as well as our own fine-tuned generative models. As different generative models have different performance characteristics, the system will time out model(s) if a maximum time is reached without generating any results. Models may also fail with an error or generate content not appropriate for our task (in this case the generated image is deleted immediately). For these reasons, each request may produce a slightly different amount of images.

3 EXPERIMENTAL STUDY

We test whether using generative AI in step 3 (Design Task) can increase users' feelings of empathy for a target person above and beyond reflecting on the contents of the story.

3.1 Participants and Materials

We recruited 322 online participants. We excluded three participants who failed the comprehension check and one participant who provided nonsensical answers when uploading their photo in the first step. Thus, our final sample size was 318 participants (158 male, 156 female, 4 genderqueer or non-binary, median age group: 36-45 years old).

While any clustering algorithm can be used for the second step of the framework, we used agglomerative clustering here. As stated in Section 2, our framework is meant to support any open-source inpainting model. For this study, we used Blended Diffusion [1], Runway SD Inpaint [18], OpenAI [15], and GLIGEN [11].

3.2 Methods

After providing consent, our study directed participants to our platform, where they began step 1 of the system ("Upload"). They were told to share places they found safe or welcoming (i.e., participants were randomized to see either "safe" or "welcoming"). Afterwards, participants completed step 2 ("Match and Read"). After reading, participants indicated the degree of empathy they felt towards the

target person ("To what extent did you feel touched, sympathetic, or compassionate while reading the narrative?"; pre-task empathy).

To test our hypothesis, we randomized participants to do one of three tasks at step 3: (1) **Redesign own**: Use generative AI to redesign the space in their original photo to make it more inclusive for the target person, (2) **Redesign preset**: Use generative AI to redesign a generic space in a photo provided by us (the photo was identical across all participants in this condition) to make it more inclusive for the target person, or (3) **Describe**: "Write in explicit detail" what they could recall from the photo.

After completing the task (*redesign own*, *redesign preset*, or *describe*), all participants were asked how much they empathized with the target person by rating their degree of empathy, compassion, and sympathy on three separate sliding scales ranging from 0, *Not at all*, to 100, *Very much*. Participants rated how well they understood the target person's point of view on a sliding scale ranging from -100, *Not well at all*, to 100, *Extremely well*. These scales showed good reliability (Cronbach's alpha = 0.90 after rescaling the understanding rating), as might be expected from other studies on empathy [6]. Thus, we averaged across these four measures to generate a general post-task empathy rating.

Participants then repeated this process (*upload*, *match and read*, *task*) for the other general place type. If a participant had been initially asked in the first step to upload a place that they found *safe*, then they would repeat the process, starting with uploading a photo of a place they found *welcoming*, and vice versa.

Finally, we asked participants to complete the 20-item General Attitudes towards Artificial Intelligence Scale (GAAIS) [19]. Embedded in the GAAIS was a comprehension check ("Please select 'Strongly Agree'"). While participants completed the scale, our system finished image generation. Participants in the two redesign conditions then viewed the generated images and rated the quality of the generated images, how well the generated images matched their intention, and how well the generated images communicated their ideas to others. As the participants in the *describe* condition did not interact with generative AI, they skipped this step. Since responses on the GAAIS and ratings of the generated images fall outside the scope of the main research question, we do not discuss them further. Finally, participants answered demographic questions (e.g., age category and gender) and were debriefed.

3.3 Results

There was a significant main effect of condition on the amount of post-task empathy reported by participants ($F(2, 633) = 3.998$, $p = .0188$; see left panel of Figure 3). Participants in the *describe* condition ($M = 59.97$, $SD = 25.90$) reported feeling lower levels of post-task empathy compared to participants in the *redesign own* ($M = 65.18$, $SD = 26.20$; mean difference = 5.21, $t(633) = 2.17$, $p = 0.0307$) and "redesign preset" conditions ($M = 66.44$, $SD = 23.28$, mean difference = 6.47, $t(633) = 2.63$, $p = .0088$).

To examine how empathy ratings changed before and after the tasks, we subtracted pre-task empathy ratings from the post-task empathy ratings. This allowed us to examine the degree of change in empathy as a result of the task.

An ANOVA showed a main effect of task condition on the increase in empathy reported for the target person ($F(2, 633) = 2.9137$, $p = .055$; see right panel of Figure 3). Participants asked to describe the photo reported a smaller increase in empathy ($M = 12.55$, $SD = 20.59$) compared to participants who used generative AI to edit their own photo ($M = 17.36$, $SD = 22.27$; mean difference = 4.812, $t(633) = 2.31$, $p = .0211$) and compared to participants who used our generative AI tool to edit a place in a photo given to them ($M = 16.18$, $SD = 22.66$; mean difference = 3.64, $t(633) = 1.71$, $p = .0881$).

4 DISCUSSION

Our system leverages innovations in generative AI to encourage people to design for one another. This forces users to actively do perspective-taking, rather than merely read someone's account passively. Our experiment found that designing interactively with generative AI helps users experience more empathy and understanding of a very different person. This suggests that novel technologies such as generative AI, when implemented in systems that ask users to design for one another, can help to engender greater interpersonal empathy and understanding.

These findings also suggest that technology that actively engages the user in the process of *creation*, whether that be through new art, inserting a playground, or otherwise changing a place, may help to induce more empathy. While other studies ask users to act on information by writing to an imagined person, making donations, or signing petitions [7], our system asks users to design something new. Asking users to visualize and create a concrete artifact such as an image, rather than perform a task with intangible results, may promote further individual and collective action in the real world beyond so-called "slacktivism". Though it remains an open question as to whether the design needs to be visual (e.g., would language or music work?), empowering the user to create based on some knowledge about someone else may foster empathy.

In a similar manner, asking participants to redesign their own uploaded images resulted in a slightly larger increase of empathy compared to asking participants to redesign a preset place (right panel of Figure 3). Perhaps by having to modify (albeit not permanently) a real and familiar place, rather than an abstract generic space, and "giving up" something they value, users experienced greater empathy for the target person. One possible way to increase this realism and potentially engender greater empathy and understanding between people might be to allow people to design and view creations more immersively and in-situ, leveraging technologies such as extended reality. This is a feature that we are actively developing.

Additionally, in the system, we constrained the conversation to places and spaces, rather than providing more detail about the target person. This constraint may have made it easier for users to empathize with target persons. A possible extension of the system could add or reduce details about the target person. This leaves an open question about how more detailed or more abstract representations of the target person would affect the user's empathy. We could examine this by comparing the empathic accuracy of users when they have constrained versus full information about a target person.

Of course, it remains the case that users do not have to engage entirely with the target person's story. A user could disregard the story and halfheartedly design a "solution". Conversely, did the use

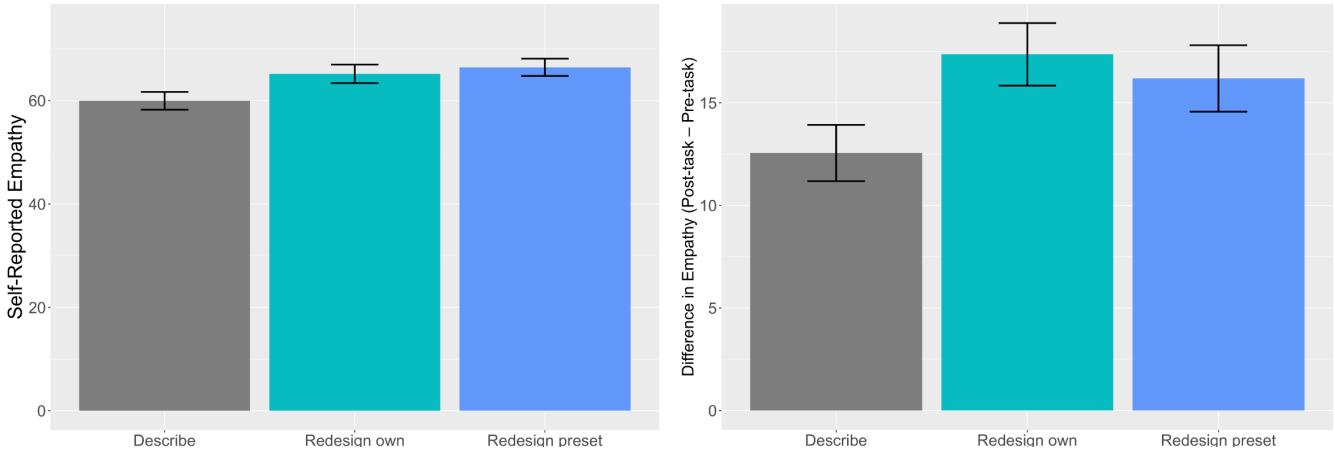

Figure 3: (left) Mean empathy ratings for the target person after the respective task. (right) Growth in empathy after completing the task. Bars represent standard errors.

of generative AI help the target person feel understood? Rather than reading an apology or a short note, does seeing what others have tried to design help the target person not only better understand the user but also feel that the user empathized with them? In future studies, we will solicit feedback and evaluation of the creations by the target person in order to address these questions.

Finally, while the system in this particular instance was designed to prompt users about places that are important to their personal lives, the focus of the system need not be places and spaces per se. One could re-purpose the system to help users empathize with other people through, for example, seeing moments or things that other people treasure and value. Users could then use generative AI to design a work of art or a novel item for another person.

4.1 Designing with generative AI as a tool for interpersonal connection

It is important to note that our particular choice of medium has its benefits, as generative AI can help to reduce barriers to entry. Across different media, the communication of one's ideas can be difficult. Seeing a visualization of a proposed solution may facilitate communication between two people, and lowering the barriers to doing that through a virtual medium can further expedite this conversation. Rather than having to build a prototype or a clay model, users can specify what they mean more easily using our system. Similarly, users can visualize each other's intentions easily. This can, in turn, reduce misunderstandings and help parties to come to an agreement.

On a related note, rather than needing artistic skill or falling victim to the inherent degree of inaccuracy in communication, the use of generative AI can help users more accurately convey their intentions and meanings and thereby create shared representations of the world. Without being a fountain designer, users can place a fountain of their choice in their local neighborhood and submit the idea for others to consider. This democratizes the process of planning, and further work should be done to make generative AI tools easier to use for all demographics. It is important to note, however, that this can lead to unintended consequences. It might lead parties to become too anchored to particular aspects of the design space, thereby unintentionally constraining the conversation and preventing people from accepting or imagining better solutions. A possible solution might be to have a moderator monitor and nudge the discussion to remind users of the bigger picture.

The use of generative AI, especially when dealing with physical spaces, can also help visually oriented users connect better. If "seeing is believing", then perhaps being able to see alternative solutions in space without much effort and investment may facilitate the social connection between the user and the target person. An open question is whether users would report larger increases in empathy if they could additionally see the output from the generative AI models. In our study, participants simply had to redesign with the tool, but they were asked to report their empathy prior to seeing the output from the models. In future studies using our platform, we will examine whether this is the case.

5 CONCLUSION

Designing successfully for others involves considering their opinions and goals. This can be challenging for non-experts. We found that a system we built, which leverages innovations in generative AI to lower the floor for design, can help facilitate discussions between people around the redesign of public spaces. By focusing on the information presented about disparate others and by allowing users to act on that information in a meaningful way through design, we show that this can also engender greater degrees of empathy for the other person. This approach has the additional advantage of decreasing communicative misunderstandings through building shared representations between users.

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