Smart Cities for Bridging the Urban-Rural Divide: Designing Small-Town Smart City Visions through a Speculative Design Approach Led by Feminist HCI Values

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Abstract

Urbanization has increasingly drawn people to metropolises, leaving small towns struggling with declining populations and insufficient infrastructure. This contribution reflects on and evaluates the methodology utilised in the context of a study dedicated to exploring the potential of integrating feminist Human-Computer Interaction (HCI) principles within the framework of rural smart cities to address the infrastructural and social disparities between urban and rural areas. Through speculative design methodologies, the research aimed to identify the unique needs and challenges faced by residents in small cities and rural regions, and to propose innovative smart city solutions that incorporate feminist values. The study involved speculative workshops in Weimar, which engaged participants in activities designed to elicit visions of ideal urban environments. The findings highlight participants' wishes for integrating nature, ensuring safety and comfort, and promoting social values such as direct democracy and freedom of expression. At the same time, dystopian views emerged around themes of excessive technology use, loss of human connection, and environmental degradation. We reflect on the effectiveness of speculative design as a research method and outlines plans for future research.

CCS Concepts

• **Human-centered computing** → *HCI theory, concepts and models.*

Keywords

Rural Smart Cities, Smart Cities, Feminism, Values-based Design, Speculation, Speculative Futures

*These authors run the workshops as a team during a semester project.

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1 Introduction

The global urbanization process draws more and more people to the metropolises, often leaving small towns abandoned [32]. Big cities are especially appealing to younger generations who seek opportunities for building their lives, including jobs, comfort, accessibility, and entertainment [10]. However, this migration creates significant challenge, as big cities are getting overpopulated and turn into the opposite of what people seek, with rents going up, crime rates rising andopportunities not being able to fulfil the actual demand [15, 17, 23].

Rural smart cities offer opportunities to bridge the gap between urban and rural living standards through innovative technology solutions and allow for bringing the comfort sought by people in the big cities to small towns [28, 29]. Nonetheless, like smart cities in general, such urban entities face infrastructural and social challenges as well, such as underrepresented citizens and limited access to services and amenities [2]. The challenge of building the future small-town smart cities requires finding ways to address similar design challenges: citizen participation and a broad view of the problem to address design questions from different standpoints [18, 19, 27].

The aim of the study discussed here was to explore potential methodological approaches for creating future 'smart city' visions together with citizens, while incorporating feminist values through said approaches.

2 Background

The integration of technology into urban life has given rise to the concept of smart cities, which aim to enhance the quality of life for their residents through innovations in infrastructure, services,

and governance. However, the involvement of multiple stakeholders with different interests as well as material and technological constraints add complexity to the creation of cities worth living in [9, 11, 12, 20, 24]. Among other issues, unequal levels of community involvement reveal a significant shortcoming in urban planning, where the views and needs of diverse demographic groups are often overlooked [16].

Bridging the urban-rural gap is crucial for developing inclusive and fair small-town environments that cater to everyone – and HCI could play a vital role in addressing this. By incorporating feminist HCI values [7], we can ensure that solutions are inclusive and equitable, catering to the diverse needs of all residents. According to Bardzell [7], these values are: **Pluralism:** creating designs that recognise and accommodate multiple perspectives and needs, rather than assuming a one-size-fits-all solution, **participation:** involving people who will be affected by a design in the process of creating it, **advocacy:** designing tools and solutions that support and improve the lives of underrepresented or disadvantaged groups, **ecology:** being mindful of the fact that design choices impact the larger environment, shape our behavior, and influence everyone involved, **embodiment:** focusing on how designs interact with the physical and emotional experiences of users, recognising that these experiences can differ between individuals, and **self-disclosure:** allowing users to understand and control how a system represents and uses their personal information.

Further inspired by research relevant to rural smart cities [2, 4, 5, 13, 14, 25, 26, 28–31], the topic explored in the study we here report on relates to key infrastructural and social needs and challenges encountered by residents of small cities and rural areas, and how these could be addressed by feminist HCI values incorporated in a rural smart city context.

As research method to explore this topic we chose workshops where participants engaged in speculative activities, since speculative design practices provide a way to imagine, explore, and critically engage with societal values, future designs, and potential scenarios through design [6]. Such methods have already been used to envision both positive and negative possibilities for urban development [21, 33, 34], and provided inspiration when designing the workshop process.

Our study combines the concepts of smart cities, feminist Human-Computer Interaction (HCI), and speculative design. The broader goal was to provide recommendations on how to bridge the gap between rural and urban living standards through innovative smart city solutions, while incorporating feminist principles, which emphasise inclusivity, diversity, and social responsibility [7, 8]. We here reflect on the speculative methodology used for the study, evaluate its effectiveness in addressing the research question, and outline plans for future research.

3 Research Design and Method

The research question investigated via the workshops could be formulated as follows: "What are the primary infrastructural and social needs and challenges faced by residents of small cities and rural areas, and how do these differ from urban areas in terms of lacking services or amenities that could enhance their quality of life?" To investigate the research question, speculation was selected as a research method, and three speculative workshops were executed in total.

The workshop was designed to explore issues related to smart cities and rural areas. It sought to identify the specific needs of residents in small cities and rural areas, to uncover unique challenges and requirements, and to examine whether smart city technologies can offer solutions that eliminate the need for migration from rural to urban areas by providing similar (or higher) quality of life. The workshop also delved into the perspectives of smart city stakeholders on the integration of feminist values, assessing peoples' priorities and their implications. Additionally, it provided insight into the views of small city inhabitants regarding the quality of life in their communities.

In order to reflect on the embedding of values in speculation, the workshop was built around introducing and embedding feminist HCI values on every step of the procedure.

Participants were recruited through various methods, including snowball sampling by asking friends and acquaintances, street marketing by engaging with people in local stores and around the university, and via digital platforms such as university pin-boards, and social media to attract local residents. Participants had to fulfil no requirements to take part. Overall there were nine participants (four in the 1st, three in the 2nd, two in the 3rd workshop), five women and four men, eight in the age group 19-29, one in the age-group 30-39, and all residents of the small-town Weimar. The workshops took place in Weimar. The materials utilised in the workshops were sticky notes, pens, pieces of paper, boards to put the sticky notes on, and printed photographs from the participants.

3.1 Workshop Structure

Each workshop took approximately two hours. Below, the workshop activities are outlined.

Pre-workshop Activities: Prior to the workshop, the participants were given consent forms, a demographics survey, as well as an information sheet about the research. As a pre-workshop task, they were asked to select one image which to them represents a utopian city, and one which represents a dystopian city. These images were sent to the researchers, were printed beforehand and used later in the workshop. A further pre-workshop task was for participants to take a walk around town and take pictures.

Step 1 - Introduction: The workshop began with gathering all participants in a work space, where they were briefed about the research. The briefing provided a general overview of speculative design, feminist principles, smart city dimensions, and an additional explanation of the terms "Utopia" and "Dystopia", ensuring participants understand the context and goals of the workshop. Participants were encouraged to ask any questions they may have have.

Step 2 - Ice-breaker: Following the initial briefing, participants introduced themselves and talked about the images they had selected prior to the workshop, explaining their individual choices and discussing them with the group. This discussion focused on identifying utopian and dystopian features from the photographs they had brought. Next, the participants were tasked to create a vision board by pasting these photos and writing their thoughts

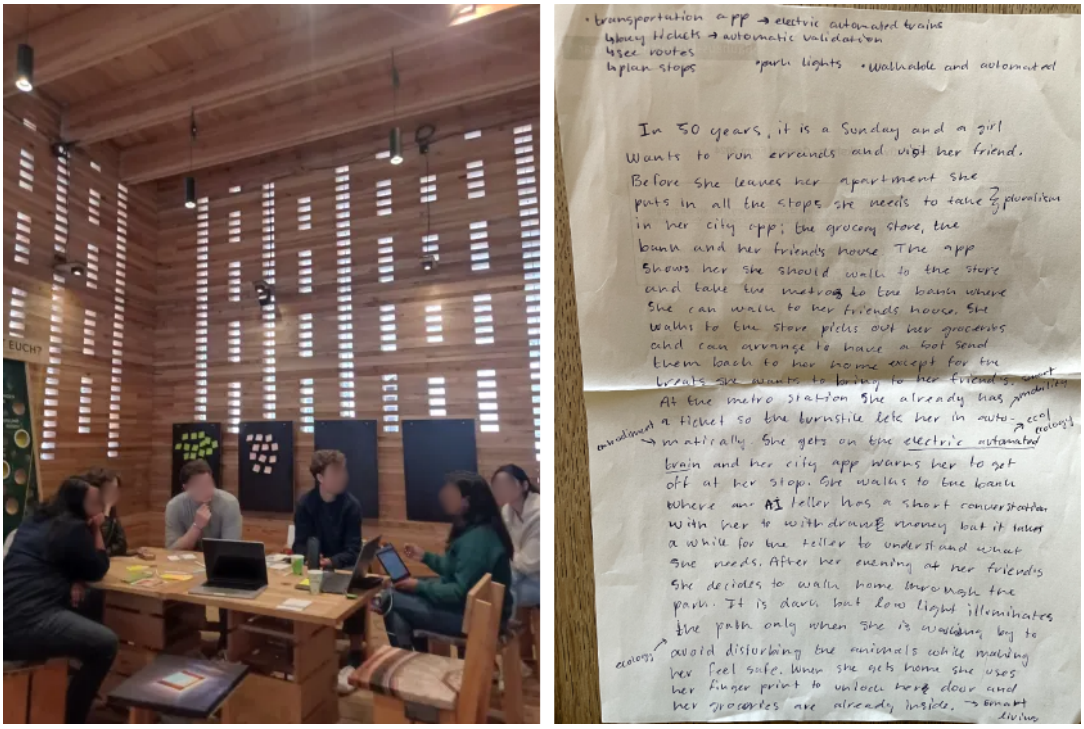

Figure 1: Left: Workshop in progress. Right: One outcome from the story-telling session.

on sticky notes, which they then attached to the board. This activity encouraged participants to think critically about the ideal and undesirable aspects of urban living.

Step 3 - Storytelling and Comic Session: Next, participants were given a prompt (see appendix) to create narratives set in a future city. These prompts were based on the values and dimensions discussed earlier. Participants could choose to either write a story or to create comic strips depicting their vision of a future city, incorporating elements they believed are essential for an ideal urban environment. This creative exercise was to allow participants to explore speculative futures and articulate their ideas in an imaginative format.

Step 4 - City Walk Discussion: Participants were then requested to talk about the observations they had made during their city walk around town before the workshop, and to take notes on features they would wish to see in a smart city, considering the previously discussed values and dimensions, as well as how these features could be integrated into a smart city framework. This activity grounded the discussion in real-world observations, and at the same time encouraged collaborative thinking about practical implementations.

4 Analysis

The data collected from workshops were video recordings of the entire workshop procedure, the photographs provided by participants, the sticky notes written by them, as well as sketches created.

Until present, thematic analysis of the sticky notes has been done using MAXQDA for coding. Although still unfinished, analysis has already uncovered participants' perspectives on smart cities and the integration of feminist principles, helping to inform future research and interventions in urban planning and design.

5 Results

The results recorded below are derived from the 2nd, 3rd and 4th stage of the workshop, as presented in the "Workshop Structure" section.

Participants' conceptions of utopia and ideas for positive changes can be grouped into several core categories. Environmental and ecological integration is a prominent theme, with a focus on incorporating nature into everyday life, including green areas, closeness with animals, and a balance between nature preservation and technological advancement. Safety and comfort were also emphasised, with a desire for safe public spaces, shelters, bike lanes, and technologies that enhance living comfort. Public and recreational spaces also appeared to be important to participants, such as accessible, free leisure areas, mixed-use spaces, and well-designed, walkable environments. Social values highlighted by participants include direct democracy, freedom of expression, and spaces that support mental well-being and productivity. Lastly, modern aesthetics and futuristic elements were also noted, with an appreciation for eye-catching designs, calming atmospheres, and a sense of openness and connectivity.

Participants' views on dystopia and their observations on negative aspects of urban environments also revolved around several key concerns. Over-reliance on technology is a major theme, encompassing issues such as excessive surveillance, technology used

for oppression, and robots replacing human interaction. Loss of human connection and freedom is another critical category, highlighting lack of privacy, freedom of speech, and a society dominated by censorship, dictatorship, and social scoring. Environmental and spatial issues include tall buildings, overcrowding, a lack of green spaces, and an environment with no nature. Societal problems, such as poor mental health, unproductive lifestyles, and a lack of recreational opportunities completed the participants' vision of a dystopian world.

As for the speculative stories and comics, they included visions of pluralism in Weimar that successfully cater to the needs of a left-handed person and to a person with poor eyesight, and ecological visions, such as a bio-degradable vehicle constructed exclusively out of spaghetti that operates through tomato juice, or mobile swamps that are used to provide greenery and prevent flooding. Two stories described modernised public transport systems, underlining the need for good infrastructure in a town, while another comic presented an idealised political scenario where right-wing extremists and liberals engage in peaceful negotiations, with both sides showing mutual understanding and respect for each other's views, emphasising the study participants' desire for a democratic society where opposing ideologies can coexist and find common ground through dialogue.

6 Discussion and Reflection

By utilising speculative design practices, the research aimed to help participants to not only identify needs, but also to envision potential smart city solutions that could reduce the need for migration from rural to urban areas by improving rural living conditions. The pre-workshop activities, including image selection and city walks, were designed to start the participants' critical reflection and creative thinking. During workshops, the structured activities — ranging from ice-breaker tasks to storytelling and comic creation — were designed to foster exchange of ideas and encourage envisioning of future scenarios for rural smart cities.

The data collected, including video recordings, photographs, sticky notes, and sketches, provide a multifaceted view of participants' insights and prove that the participants embedded feminist HCI values into their speculative designs successfully. In particular, the results produced during the storytelling and comic session show that participants understood the importance of giving priority to values such as inclusivity, advocacy, participation, ecological consciousness, and social responsibility when designing the future. We consider this a positive result of our choice of method.

However, while speculative design encourages creative thinking, it may not always produce actionable or practical solutions. One example of an unrealistic and impossible idea being proposed was the spaghetti-vehicle (although one could take inspiration from it, for instance on using biodegradable materials for vehicle construction). Another problematic aspect observed was that the outcomes of speculative design can be highly subjective and influenced by participants' personal experiences, beliefs, and biases. This subjectivity can make it difficult to generalise findings, and can sometimes also affect the procedure of the study. For instance, in one of the workshops a discussion emerged when a participant suggested during the storytelling activity, that in a utopian world, right-wing extremists and liberals would engage in peaceful negotiations resulting in compromises. This perspective prompted varied reactions from the other participants.

7 Outlook and Future Work

The next steps to be taken for our research is transcribing the dialogues, discussions, and speculations recorded on video in order to uncover further insights into the participants' views. Afterwards, thematic analysis will be utilized to identify common patterns and unique ideas.

Future plans involve a further large-scale questionnaire-based study to complement our main research. The survey will address similar questions regarding the problems faced by rural residents and will offer a space for speculating stories in written and unmoderated form. The questionnaire has already been developed and is currently being distributed to participants. Our hope is to involve a wider variety of stakeholders, such as local government officials, urban planners, and technology providers.

Lastly, we aim to re-work the procedure and to run more studies over the next year with speculation at the core, but different modes of designing the visions. In some points, the implementation of the method could be improved, for instance, a broader sampling with a more diverse range of participants. This could involve targeting different demographic groups and geographic areas to ensure a broader representation of perspectives and experiences. Additionally, it would be beneficial to include more participants who have extended experience of living in small towns, given it was noted that criticism of Weimar, where the study was conducted, was limited, likely because most participants were more accustomed to large cities and struggled to identify significant issues within the smaller town context.

Developing more detailed speculative scenarios related to rural smart cities or towns could also be useful in order to prevent participants from feeling overwhelmed in the creative process. For example, providing participants with specific scenarios such as "a futuristic rural healthcare system" or "a smart agricultural technology that integrates feminist HCI principles." This could help focus discussions and make speculative design activities more targeted. Collaborative storytelling sessions, where small groups of participants co-create narratives or comic strips, instead of doing this individually as was done during the workshops, could also foster richer speculative designs and encourage diverse viewpoints.

During the storytelling session, whenever a participant explained their vision of a utopian world, a researcher facilitating the workshop asked the questions: "For whom would this vision be a utopia? For whom would it be a dystopia?" Following this track, another approach that could be useful is to integrate role-playing exercises [22] where participants assume different roles (e.g., city planners, local residents, tech developers) and address specific challenges or opportunities from their perspectives.

While these process additions and adaptions could be useful, time constraints kept the research team from incorporating the above-mentioned activities into the workshop. The design and structure prioritised keeping the workshop within a 2-hour time

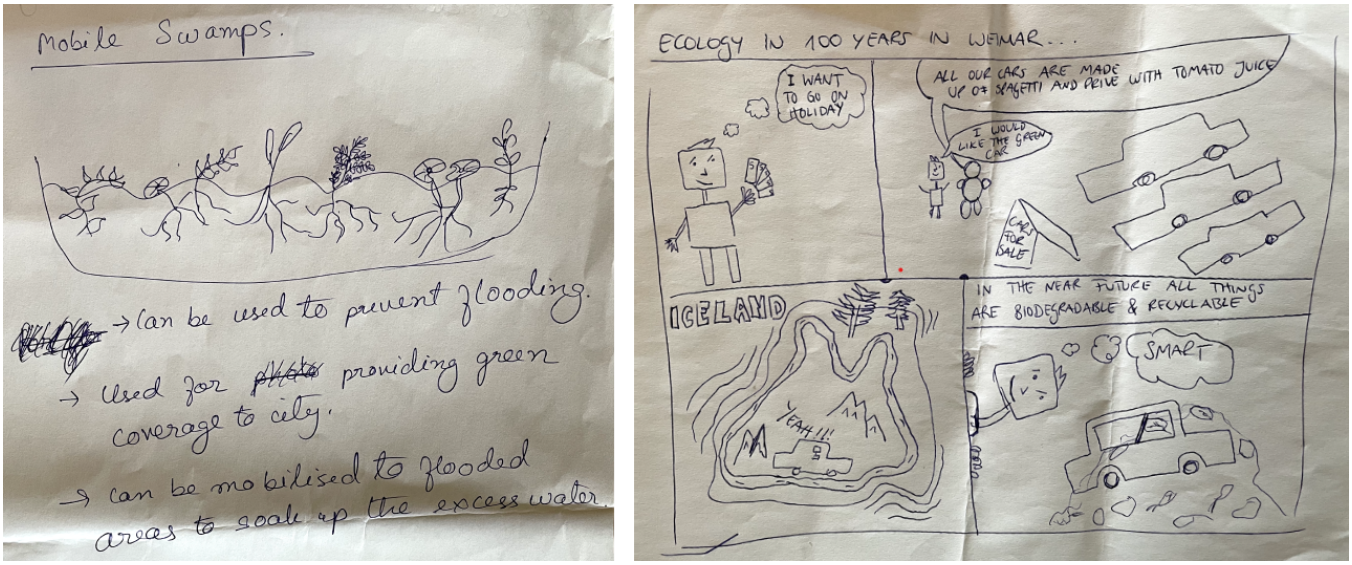

Figure 2: Examples of comic strips produced during the story-telling session.

frame to avoid participant fatigue, which could negatively impact their experience and the quality of results.

8 Conclusion

All in all, the use of speculative workshops proved effective in engaging participants and revealing diverse perspectives on both ideal and dystopian urban futures. Creative and reflective thinking about infrastructural and social needs was successfully encouraged. However, while the workshops successfully generated valuable insights, the approach also revealed weaknesses of the speculative method utilized, as well as areas for improvement in refining how speculative activities are designed and executed. Future research should build on these findings by further developing and testing speculative design methods to better address the complexities of rural smart city challenges and provide more insightful outcomes.

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A Appendix

Below is the example-story that played the role of a prompt to inspire participants in the context of the storytelling and comic session of the workshop.

"You awaken in a cold, dimly lit room, your body resting on a stone bed covered with a rough woolen blanket. The bed beneath you is hard, made entirely of stone. Pushing off the heavy wool blanket, you swing your legs over the side of the bed and step onto the rough, uneven stone floor. Your stone hut is situated in a small clearing, surrounded by dense forest. Before you, stands a small structure made of bamboo and straw. This is your toilet. After attending to your needs, you return to your home and tend to fire. You fill it with water from a clay pitcher, its surface cool and rough under your fingers. Carefully, you set the bowl near the fire to heat. The fireplace, blackened from years of use, emits a steady warmth that fills the room. While the water heats, you take a piece of meat from a nearby wooden shelf, leftover from your hunt and cooked the night before. Its savory aroma fills the room as you eat, savoring each bite. The meat is tough but nourishing, a testament to your skills as a hunter. After your meal, you dress in your leather and wool clothing. The leather is worn but sturdy, covering your essential parts, while the wool provides much-needed insulation against the morning chill. You then take your hunting tools, laying them out on the stone table. You sharpen the edges of your knife and check the condition of your bow and arrows. You step outside into the forest, ready to hunt. Eventually, you return home, the fruits of your labor slung over your shoulder."

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