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5 Citizen science, smart art & place making: **conference paper**

Validity of Citizen Science: A qualitative and arts-based evaluation from the perspectives of citizens, academics, artists and ICT-specialists

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Abstract: Increasingly, academics and non-academics collaborate in citizen science projects. However, less attention is paid to the experiences of the validity of citizen science projects for all involved. This study gained insight into the validity experience based on the perspectives of all actively involved people in a Dutch citizen science study focusing on social innovation in public spaces. An evaluation design was used as a methodology, which contained a variety of qualitative and arts-based methods, including sessions, observations, and an open questionnaire. Six validity types of the International Collaboration of Participatory Health Research (ICPHR) were used, namely participatory, intersubjective, contextual, catalytic, empathic, and ethical validity. The results showed that stakeholders' validity-related experiences were 1) diversity in methodological approaches and timelines, 2) academic funding procedure and practice, 3) experiences of responsibility and ownership, and 4) increased empathy of all those actively involved. Experiences of validity of processes in citizen science could differ from the experiences of the outputs and outcomes of a project. Finally, this evaluation shows how qualitative and arts-based methods through the lens of validity could help exchange perspectives on the process of citizen science and (in)directly contribute to increasing empathy for each other's perspectives and approaches.

Keywords: validity; citizen science; quality; participatory research; public engagement

1. Introduction

Worldwide, high ambitions to strengthen the collaboration between academia and society and partnerships outside the university are in place. Collaboration with citizens in social innovation through the design of public spaces can improve outcomes and impact and help build trust and understanding between science and society, enhance empowerment of citizens and ultimately increase the quality of life of citizens living in precarious situations (European Commission, 2021; National Programme Open Science, 2022). Citizen science (CS) is an umbrella term for participatory research approaches and social innovation, referring to the

participation of non-academics in scientific studies and other activities with scientific objectives (Eitzel et al., 2017; Haklay, 2013).

Although CS is increasing in popularity worldwide, attention to the evaluation of quality (Broekema et al., 2023), specifically the concept of validity, is still limited. Concepts such as 'internal validity' and 'external validity' are common in quantitative research. In the last decades, scholars redefined their use of the concept of validity for qualitative research (Golafshani, 2003), for example, to credibility and transferability, including techniques that can be used to meet them (Frambach, 2013). However, these definitions and techniques do not fit citizen science and more general participatory research approaches, because they do not anticipate on its participatory, inclusive and emancipatory nature. From several related fields, action research (Bradbury et al., 2019), technology innovation (Lindhult, 2019) and participatory health research (International Collaboration for Participatory Health Research (ICPHR), 2013), quality dimensions are redefined to encourage debate and reflections on validity issues related to all participants. Surprisingly, to the best of our knowledge, validity as a core concept of qualitative research rigour has not yet been discussed in the field of citizen science itself, except for the focus on the validity of data (Brown et al., 2018).

The ICPHR approach to validity (Wright et al., 2018) fits most with our 'citizen science' approach, which is focused on the empowerment of citizens by taking into account the local needs, practices and cultures in their design and implementation (Skarlatidou & Haklay, 2021). This approach to the validity of participatory research practice uses six validity types: participatory; intersubjective; contextual; catalytic; ethical; and empathic (see Table 1). Only two groups of academics have already used these criteria to evaluate the validity of their participatory studies. One of these used a 'reflexive account' to share insights on validity (Sitter et al., 2020). The other conducted a framework analysis for data gathered in a participatory evaluation study using various qualitative data-gathering methods (Seale et al., 2021). This paper aims to gain insight into the validity based on the experience and perspective of all actively involved people in a Dutch citizen science study focusing on social innovation in public spaces.

Table 1. Validity Types of Participatory Health Research (ICPHR, 2013)

Validity Types	Focus: Extent to which…
Participatory Validity	… stakeholders take an active part in research process
Intersubjective Validity	… the research is viewed as being credible and meaningful by the stakeholders from a variety of perspectives
Contextual Validity	… the research relates to the local situation
Catalytic Validity	… the research is useful in presenting new possibilities for social action
Ethical Validity	… the research focuses on whether outcomes are sound and just
Empathic Validity	… the research has increased empathy among both the participants and researchers, and both recognize the emotions and perspectives of others without judgements

2. Methods

2.1 Background and Context

The context of this study is a two-year citizen science project that took place in the Netherlands between April 2022 and 2024. The study aimed to encourage social interaction between community members, by co-creating — together with community members (with and without dementia) — an art object located in a

public space with integrated artificial intelligence (AI). The two-year study had two hypotheses: 1) AI art objects in public spaces can stimulate social interaction among community members (with and without dementia); and 2) citizens are involved in the research and design of their living environment in a valid and meaningful way by applying citizen science. This paper reports on the second hypothesis.

The team who conducted the full study was transdisciplinary: community members, academics and AI-specialists from different universities, people from an AI small enterprise, community organizations and artists. The first and last author are educated from an emancipatory paradigm with participatory methodology (Abma et al., 2019). The final author is an active scientific member of the ICPHR and has a PhD in participatory health methodology. Community members had different roles, moments and ways of engagement in this study (see Table 2). Two, and later three, leading citizen scientists were the linking pin with a larger group of community members (third to fifth authors).

Table 2. Citizens Who Were Engaged in the Citizen Science Project

Type of citizens	Involvement	Background
Active citizen scientists	Weekly basis	Two older adults (female >65 years)
Semi-active citizen scientists (working group Public Space)	Monthly basis	Six older adults (all women, one of colour >65 years)
Large group of citizens (the City-Village)	Informed by e-mail, website and newsletter and twice a year on an event	70 older adults (mixed gender, most >65 years)
Citizens in the community centre (Greet & Meet)	Group sessions (4 times during the project)	12 older adults (mixed gender and backgrounds >65 years)
Citizens with different phases of dementia (Informal care & Dementia)	Group sessions (3 times during the project in small groups, 2 times in large groups on an event)	15 older adults (mixed gender and background) >65 years

2.2 Methods of Data Gathering and Analysis

We conducted a study with a qualitative evaluation design to gain insight into the validity experiences of actively involved people in this study. We used multiple data-gathering methods and data sources with different participants at various moments (see Table 3) to increase the credibility of the findings (Frambach, 2013). First, the last author conducted a framework analysis using the six validity dimensions (Table 1). Second, a reflexive thematic analysis (Braun & Clarke, 2019) was used together with the first author. Simultaneously, the second author and the last author wrote a Dutch article about the same topic (Groot & van Buuren, 2023). In addition, and simultaneously, we wrote a Dutch product about this topic together with the third, fourth and fifth authors. The other authors reacted to the findings as a member check and deepened the themes. This paper reports mainly on the analysis of the open-ended questionnaire (Table 4) but uses other data sources to illustrate the themes. The ethics committee of the Technical University Eindhoven has approved the study (nr. ERB2024BE10), and participants consented to participate voluntarily.

Table 3. Methods Used in this Study

Methods	Data sources	Participants	Moment
Validity session	Transcripts of session	Semi-active citizen scientists (working group Public Space)	At the start of the process
Participatory observations	Diary of reflections and observations, written-out quotes based on memory after meeting	The first and last authors	Throughout the process
Reflection moments with the core team	Transcript of audio and reports of dialogue	Full active team excluding artists	Throughout the process
Individual arts-based reflections	Collage, videos and photos of dance reflections, live dance performance, poems	Authors	On meaningful moments
Arts-based group reflections	Photos and transcripts of the tableaux vivant	Semi-active citizen scientists and academic researchers (n=10)	September and November 2023
Open questionnaire	Open answers	Members of the active team (n=6)	Dec 2023
Interview	Transcript of audio	Engaged artists who were also citizens (n=3)	Feb 2024

Table 4. Questions about Validity Types in an Open Online Questionnaire (translated from Dutch)

Validity types	Question (with an addition to every question: write preferably at least two paragraphs)
Participatory Validity	1.How did you experience the participation of all involved at all stages of the study? 2.How actively did citizens participate? And how did you experience that?
Intersubjective Validity	3. To what extent was this project meaningful for stakeholders? And for you? 4.To what extent do you feel the research was credible for the people it involved (people with dementia/citizens)?
Contextual Validity	5. To what extent was the research responsive towards the local context? Research: consider both approach and topic Local context: neighbourhood, residents, use of language, etc.
Catalytic Validity	6. To what extent did you/we respond 'well' to what was needed in that environment? Give specific examples. 7. To what extent was our research project appropriate in this environment? (our topic, but also approach) 8. To what extent did the research contribute to social innovation? (What do you understand by social innovation?)
Ethical Validity	9. What effect did the research have on you? And on citizens? And was that the 'good' thing? 10. To what extent did our research contribute to justice? In particular, name examples where perhaps it did or did not?
Empathic Validity	11. To what extent did the study contribute to increasing empathy between all involved?

3. Results and analysis

Striving for validity in a citizen science study that focuses on social innovation in public spaces is presented in four themes. Validity relates to: 1) the diversity in methodological approaches and timelines; 2) the academic funding procedure and practice; 3) the experiences of responsibility and ownership; and 4) the increased empathy of all actively involved.

3.1 Diversity in Approaches and Timelines Affected Validity Differently

In this study, we worked with stakeholders from different disciplinary backgrounds (built environment, artificial intelligence, health and social care, artists, participatory methodology) and other knowledge bases (experiential knowledge of citizens, academic knowledge, professional knowledge and artistic knowledge), meaning different working approaches and different use of language (jargon). Some were mainly focused on developing and creating social digital innovation and art. Others first concentrated on the process of (participatory) research to understand local needs and find local support before developing an art object for public space. These differences were enriching, helping us become familiar with different ways of working and getting to know each other and, at the same time, leading to friction due to differences in focus, perspectives, priorities, use of specific language and pace of work. Eventually, the development process had to happen at a (too) fast pace, with less time and attention for essential design questions, such as the object's safety, electricity source, maintenance and sustainability issues. For some, the pace and focus of the process affected the experiences of the validity of the (creative) process for the outdoor object. Others were mainly

focused on finding support for the development plans from other citizens through preliminary research. The backing of citizens other than those actively involved was meaningful and important. Therefore, in this study, the intersubjective validity (meaningfulness and credibility of the process) was lowered due to the focus on the participatory validity (more people engaged and more in-depth insights into their needs).

It was a long process. And it took [1.5 years] before we could start. My energy was seeping away. But then, suddenly, we had to develop the artwork. We had six weeks, and it had to be ready. That's when all democracy went overboard. **Artist**

We made a collage about our feeling that things were going too fast [Figure 1]. The process was going too fast. It is a high-speed train, not a slow-paced easy-going local one. (…) The process [of investigating the community's needs] is time-consuming and uncertain. We wanted to take into account the wishes and needs of all kinds of citizens as a basis, but this is not a coherent group [so it takes time!]. **Active Citizen Scientist**

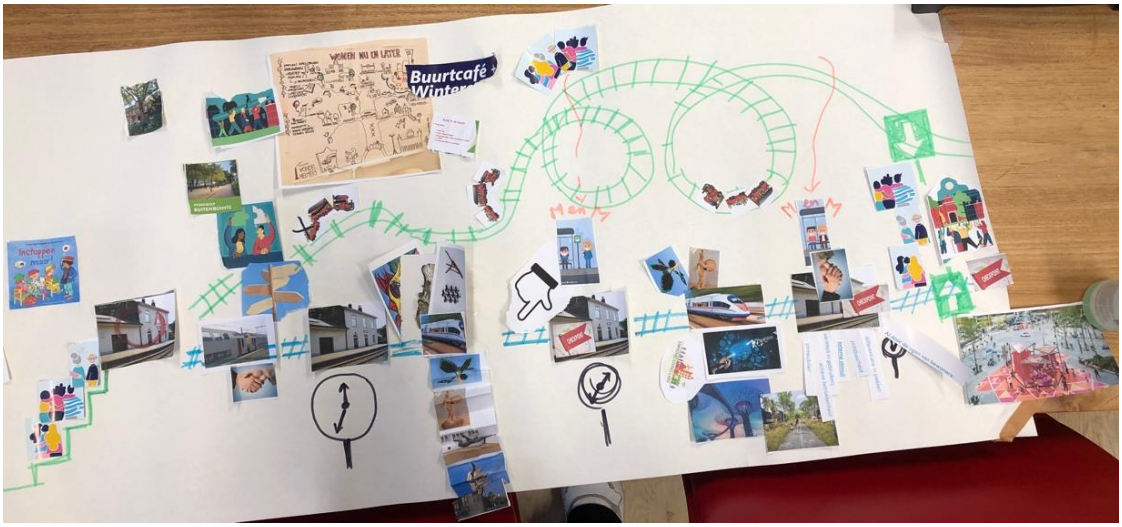

Figure 1. Collage from one of the Active Citizen Scientists about the Experience in Speed: A High-speed Train vs a Local Train

3.2 Academic Funding Procedure and Practice Impacted Validity

The National Academic Research Fund for Healthcare Research and a government agency promoting innovation in Dutch Life Sciences & Health funded the project. These funds requested a detailed academic proposal with requirements regarding commercial (AI) partners and influenced a focus on including people with dementia. This funding procedure was initiated by the funding body and academia, and stimulated a conversation and movement within the local community. Two active citizens became a permanent members of the academic research team.

This evaluation showed that most academic partners experienced participatory and contextual validity more than citizens and artists. For most academics, the participatory process was as expected and sometimes even exceeded their expectations. In addition, academics pointed out that we focused on relevant societal issues that resonated with the active citizens, so this led to a high contextual validity.

The project suited the local context. It is a creative neighbourhood where citizens enjoy living and are proud of their neighbourhood. **Academic AI-specialist**

However, the active citizens, AI partners and artists (who lived in the neighbourhood) had a different perspective on these two validity types. Although they perceived their work within the project as meaningful and learned a lot, their hopes and expectations that this project would foster social inclusion and civic engagement during the project process have yet to materialize. Citizens and artists perceived that the academic and AI focus and abstract language hindered the engagement of more citizens in the neighbourhood. Many citizens had a resistance to AI and technology and could not imagine the benefits (yet). In addition, an energy-transition project, with direct and more severe impact on the lives of the community members, asked for more attention in the neighbourhood As an example of artistic and embodied experiential knowledge, one of the academic researchers, who was also a community member, danced her reflections on the challenges during the period. See Figure 2 as an example of this which shows embodied experiences, which focus on the ups and downs in the process.

The participation of fellow community members never got off to a good start, as far as I am concerned. For them, it has always remained too abstract. Therefore, we struggled to activate people to get involved. **Active Citizen Scientist**

Figure 2. One of the Academic Researchers Who Was Also a Citizen in the Neighborhood Danced Her Reflections on Participation During the Project (https://vimeo.com/930343057?share=copy)

3.3 Experiences of Responsibility and Ownership

In the evaluation, all people involved in this project who lived in the neighbourhood (as well as active citizen scientists and artists as academic scholars) shared concerns about their feeling of a massive sense of responsibility. They were the 'face of the project' in the neighbourhood. Fellow community members were asking them about the project. This sometimes made active citizen scientists unsure. The outcome of the process was that they were unsure with regard to the full project, because it was a transdisciplinary effort in the unknown. This hindered clear communication about a concrete final product to other neighbours.

For me, the project has always been a concern. I felt a commitment but thought I never really lived up to it. At times, I did enjoy it; it was fun (…). **Active Citizen Scientist**

The main concern arose regarding ownership of the object in the public space. Questions of team members who lived in the neighbourhood were: who is responsible if something happens or people complain? Who will maintain the object? When the research grant ends, who (academics, AI specialists) will stay engaged and share the responsibility and ownership? The photograph (Figure 3) shows the emotions of different stakeholders in the process around this topic. You see a citizen with questions in the middle (woman with purple jacket), people around her who are the other team members, and an academic pointing the way to the future. The person in the middle feels alone and hopes to have support in the long run. The uncertainty about shared responsibilities during and after the end of the project lowered the ethical validity.

I worry about the material. I am willing to maintain the object, but it is not mine. **Artists**

This study also showed that ownership of an object in the public space can make people proud. If the artistic object becomes a success, it could help the people involved realize their goal of increasing social cohesion, as aspired to with this project. This affected the intersubjective validity in a positive way: it was meaningful for the people involved and the neighbourhood.

This is the most engaging day of my life in this neighbourhood. This is great! [on the day the object was built] **Active Citizen Scientist**

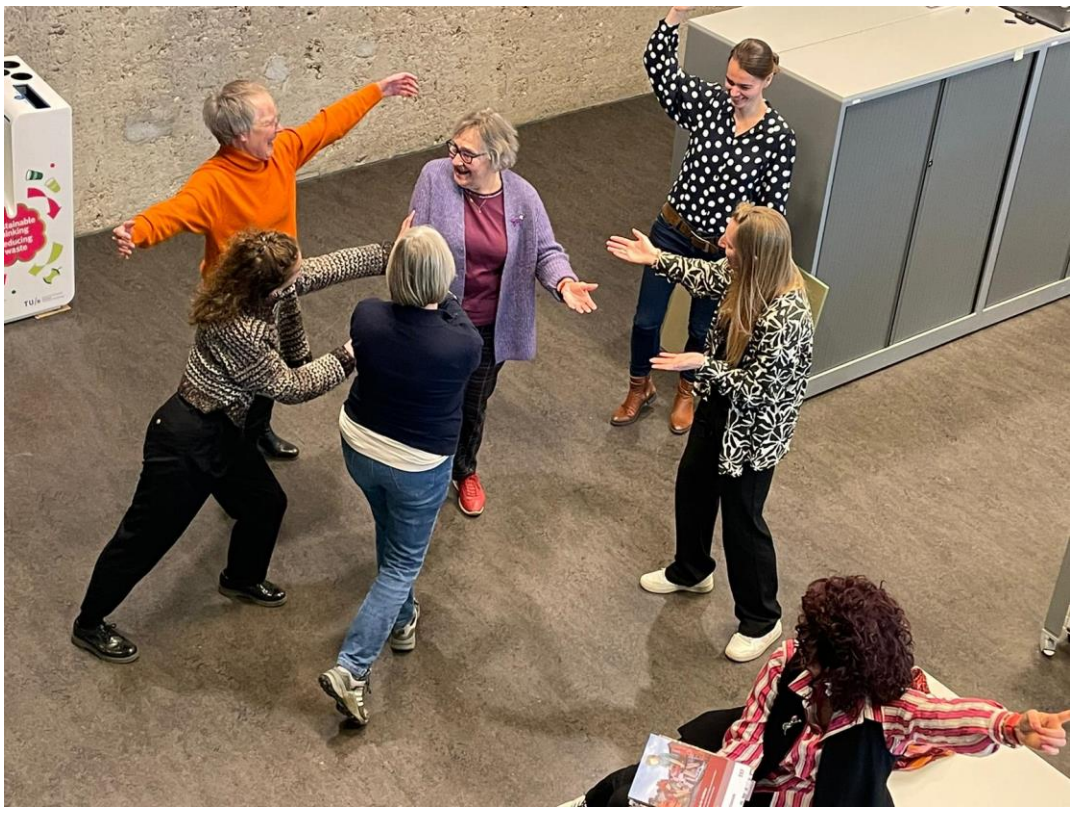

Figure 3. Research Team with Citizen Scientists and Academics Reflecting the Process in a Tableaux Vivant

3.4 Increased Empathy

Finally, this project brought a lot of empathy between the different people involved, especially between the actively involved citizens and researchers. We spent much time understanding each other's methods, language, pace, and communication. By figuring out a way of working together, empathy came naturally. Friction and frustration along the way helped and was dealt with in an open manner. In this process, all those involved showed themselves, were transparent and wanted to learn. There also seemed to be room for discomfort and fun. A good breeding ground was laid after two years. We needed time to understand each other's aims, language, vision and way of working.

Those involved show that not only did they personally learn a lot about transdisciplinary work and cooperation with citizens and academics, but they also learned a lot about how urban citizens (with dementia) think and act. The empathic validity was therefore very high for all.

An empathic connection emerged through trial and error, easy and uncomfortable moments. This also took time. It is a pity that precisely this good breeding ground will be abandoned at the end of March. **Active Citizen Scientist**

With me: it felt very strange at times to not [only] be in charge, because citizens were also in charge. I am so used to taking directions as a researcher or project coordinator, but this was different. But the difference is very positive here! Nice to see that citizens and researchers stood side by side. **Researcher**

4. Discussion

This paper showed a methodology to study validity at a process level using different qualitative and arts-based methods. See the findings in relation to the validity types in Table 5. Especially, the dimension of 'Empathic Validity' stood out in this study; the process of citizen science has increased empathy among all stakeholders involved. It showed that the validity of the process of a citizen science project could differ, mainly due to different backgrounds, working approaches, trust, and feelings of responsibility and ownership. In addition, we learned that a valid or invalid citizen science process is not necessarily the same as the validity of a study's result or outcome (like in this process, the creative outdoor object). It made clear the urgency to pay attention to monitoring separately the validity of the process and the validity of the outcome of the process. Finally, this study revealed the high impact of funding procedures and practices on validity.

Table 5: Validity types related to different findings of the study

Validity Types related to different findings	Diversity in approaches and timelines affected validity differently	Academic funding procedure and practice impacted validity	Experiences of responsibility and ownership	Increased empathy
Participatory Validity	High for all	High for academic, and low for community and AI partners and artists	x	x
Intersubjective Validity	Low for all	x	x	x
Contextual Validity	x	High for academic, and low for community partners	Only at the end of the study higher for community partners	x
Catalytic Validity	x	x	x	x
Ethical Validity	x	x	Low for some of the community partners	x
Empathic Validity	x	x	x	High for all

Ownership and responsibility are not new as practical and ethical issues in participatory and citizen science projects (Chesser et al., 2020; Fiske et al., 2019; Groot & Abma, 2022; Guerrini & McGuire, 2022; Rasmussen, 2021). However, only using validity types as evaluation criteria of validity could not oversee all these topics. First, the 4Rs framework (Guerrini & McGuire, 2022) for assessing ownership practices in citizen science is an interesting additional framework, which could ask for more attention to ownership from the start of the project in which people make a creative object. This 4Rs framework focuses on 1) reciprocal treatment, 2) relative treatment, 3) risk-benefit assessment, and 4) reasonable expectations. Including these criteria in participatory evaluation could help avoid underestimating the relevance of ownership. Feelings around ownership and responsibility could also grow or shift during the process. Second, responsibility is the other essential topic for validity in citizen science processes. The Ethics Framework of Citizen Science (Groot & Abma, 2022) could also help to be aware of the ethics work (Banks, 2013) necessary in the citizen science process. Ethics work is often invisible work that is essential to tackle everyday ethical dilemmas about responsibility: it is the effort people put into seeing ethically salient aspects of situations and working out the right course of action. A work package in every citizen science study in which team members pay attention to validity, ownership and ethics work is a pathway for valid citizen science.

5. Conclusion

Experiences of the validity of processes in citizen science could differ in experiences of the outputs and outcomes of citizen science processes. This evaluation shows how qualitative and arts-based methods could help to exchange perspectives on the process of citizen science.

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5 Citizen science, smart art & place making: **Abstract livinglab DEEL Academy**

It Takes a Village to Grow Old

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To age in place, recurring encounters in the neighbourhood could be beneficial for citizens (with dementia). Public familiarity deals with this phenomenon and the design of the physical environment – especially so-called 'fourth places' – could contribute to this, for example by using conversation starters. These conversation starters could be smart art objects which stimulate encounters. However, it is irregular to design such stimulating smart art objects with local citizens. And if doing so, often dilemmas arise where democratic participation is at stake. The aim of this living lab was to study the development of smart art objects in fourth places to stimulate social encounters using a citizen science approach. We explored the dynamics between smart art objects, place-making, and social health.

Participatory action research was integrated in the Empathic Design Framework in three iterations in a specific neighbourhood in Amsterdam: VondelHelmers. A mixed method approach was used to explore the needs, preferences, and possibilities of socio-spatial factors (e.g., diary study, photovoice, preference study), to develop design solutions (e.g., design workshops), and to evaluate the design solutions (e.g., observation, group interviews).The involvement of citizens in this process was layered: co-deciding members of the project team, consulting members of a task force, and consulting and informing a broad group of citizens. The first two groups were actively involved in conducting the research (e.g., interviewing, observing).

The developed smart art object in the neighbourhood VondelHelmers is a sheltered bench, with the possibility to exchange neighbourhood stories, both digitally (smart tablet) as with physical objects (in a showcase cabinet). First experiences with this smart art object are positive; citizens showed curiosity behaviour towards the art object. In addition, during the research and development process, involved citizens mentioned more conversations, even with neighbours they did not know before (i.e., public familiarity).

Partners: TU/e, Stadsdorp VondelHelmers, LA, HvA, UvA, illi-tv, WG-kunst, Cliëntenbelang Amsterdam, Stichting Mantelzorg & Dementie

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