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Data feminism in action: mapping Urban Belonging in Copenhagen with experimental visualization and participatory GIS

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ABSTRACT

In fields like Cultural Geography, Critical Cartography, and GIS, the post-colonial, post-representational, and feminist turns have been productive in critiquing mapmaking at the theoretical level and calling for methodological innovation of mapping practices that involve more diverse voices, situate maps in lived experience, and incorporate an intersectional approach. The article contributes to this on the level of data visualization, by examining how Data Feminism might help us reconfigure representations of urban experiences and issues within participatory urban planning. Specifically, the article explores how data feminist principles were used in action in the Urban Belonging Project; a participatory GIS initiative that engaged 32 participants from marginalized communities (lgbt+, deaf, physically disabled, mentally vulnerable, ethnic minorities, internationals, and/or homeless) in mapping experiences of belonging in Copenhagen. Presenting speculative visualization experiments from the project, the article puts forward three provocations for how to incorporate data feminism in participatory GIS and trouble established visual conventions: First, it crafts different visualization techniques for representing the concept of intersectionality in maps. Second, it suggests visual strategies for challenging official city boundaries and situating the spatial framing of urban issues in subjective, experiential realities. Third, it turns the empirical eye onto professional planners, demonstrating that participatory mapping can not only diversify understanding about those who inhabit cities but also illuminate blind spots and bias among those who design it. The article serves as a blueprint for rethinking how we visualize urban issues from data feminist principles while critically reflecting on the implications and dilemmas of such strategies.

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Introduction: no spatial justice without data justice

In the planning and governing of cities, mapping has historically acted as a dominant ‘way of knowing’ cities, shaping how design and policy decisions are made about urban problems (Kurgan and Brawley 2019). Charles Booth’s maps of 1889 London, for example, famously changed the understanding of the poverty problem from a moral question of church-going to a practical issue of unemployment (Vaughan 2018), informing new social reforms. Using mapping for a more discriminatory purpose, the 1930s redline maps of major American cities used demographic data to categorise neighbourhoods according to mortgage lending risk standards, typically deeming Black communities ‘high risk’ and resulting in racialised dis-investment that has enduring impacts today (Nelson and Ayers 2020; Salazar-Miranda et al. 2024). Similarly, Indigenous and native studies have documented how mapping has been used historically by settler-colonial Empires to subjugate land, resources, and people to imperial control (Schultz 2018). Mapmaking, in other words, is not a neutral endeavour. Opposed to scientific cartography, which has conventionally framed maps as objective and apolitical, scholars of Critical Cartography and Cultural Geography have highlighted that mapping is imbued with power, values, and judgments by those who create them. Seeing maps as social constructions and drawing on notions of knowledge as power found in Michel Foucault and Jacques Derrida, Harley (1989) demonstrated that map-making involves decisions that give visual priority to some things, while omitting others, creating a dialectic of inscription and erasure (Engelmann, Humphrey, and Lynteris 2016). Maps, in these views, are not just products of power, but also produce power (Krygier and Wood 2009; Pickles 1995).

Over the past decades, such critiques have motivated ‘post-colonial’ (King 2003), ‘post-representational’ (Kitchin and Dodge 2007), and ‘participatory’ (Elwood 2006) turns, which, among other things call for a reconfiguration of mapping practices that move towards alternative assemblages of power and space (Jacobs 2003), involves marginalized communities in mapping issues (Costanza-Chock 2020), and replaces universalizing knowledge production with a focus on diverse, situated experiences (Rose-Redwood et al. 2020). Such critiques have been productive in rethinking maps at the theoretical level, and have fueled empirical practices like counter-mapping (Peluso 1995), feminist GIS (Elwood and Leszczynski 2018), critical GIS (Pavlovskaya 2018), participatory GIS (Kahila-Tani et al. 2016), and others. While such approaches have especially innovated *how* mapping projects are carried out and *who* is invited to map, they also have underscored the need for innovating map-making on the level of *visualization*. This is essential, as our ability to represent lived experiences and diverse perceptions of urban issues with complexity and nuance remains limited by conventions of visualization (Kennedy et al.

2016). In light of this, feminist scholars like D'Ignazio and Bhargava (2020), Rodighiero (2020), Gray et al. (2016), Thylstrup and Veel (2017), Bravo, Rufs, and Moyano (2022), and D'Ignazio et al. (2021) call for more research that builds a critical, feminist literacy around visualization. This is what this article engages with, exploring as its overall research problem what the framework of Data Feminism, presented by Catherine D'Ignazio and Lauren Klein (2020) might offer to reconfiguring visualization practices within participatory GIS and urban planning.

The article investigates this through the case-study of the Urban Belonging Project (2020-2022). First, the article outlines 'Data Feminism' as a framework and situates visualization as a site of intervention for data feminist mapping. Second, the method and data of the Urban Belonging Project is introduced. This is followed by a results section in three parts that present strategies for visualizing urban issues informed by data feminist principles while reflecting critically on dilemmas and tensions in them.

Turning to the toolbox of data feminism

Data feminism, as put forward by D'Ignazio and Klien (2020), introduces critical feminist theory in data science, and begins from the appreciation that human relations produced and reproduced through data are unequal and that data infrastructures and technology systems are imbued with power, reinscribing forces of privilege and oppression from racist, sexist, classist, and other structures (D'Ignazio et al. 2021, 3).

Outlined as an *intersectional* framework, data feminism builds on Black feminist scholars like Kimberle Crenshaw (1991) and Jennifer Nash (2018), who have used the term 'intersectionality' to describe how systems of oppression and privilege intertwine to form person's identity and unique lived experiences. The term was coined by Crenshaw in 1989 to capture the ways in which various forms of inequality intersect to create effects that are greater than the sum of its parts (e.g. racism and sexism). Unpacking this, Crenshaw writes: 'The problem with identity politics is not that it fails to transcend difference, as some critics charge, but rather the opposite - that it frequently conflates or ignores intragroup differences' (1991, 1242). Any analysis, Crenshaw argued, that does not take intersectionality into account will not sufficiently address the particular ways in which people (e.g. Black women) are subordinated or experience the world. Key to a data feminist approach is therefore attention to how intersecting dynamics of privilege and oppression blend together in ways that might multiply their effects and manifest differently in different cultures and contexts (D'Ignazio and Klein 2020). While intersectionality has become a core analytic tool for most feminist and anti-racist researchers, Jennifer Nash (2008) critically exposes a set of tensions within intersectionality scholarship today. Among them are the lack of a

defined intersectional methodology and the empirical validity of intersectionality, and Nash (2008) encourages scholars to grapple with this methodological murkiness. Taking this seriously, it is the aim of this article to contribute methodologically to discussions of how to turn theory into empirical praxis when mapping urban experiences.

While data feminism brings critical attention to how data has historically been used by those in power to consolidate control, D'Ignazio & Klein argue that data might equally be used to expose injustice, topple governments, and rework power hierarchies (2020, 17). Data feminism hereby is a call to action for reworking power asymmetries and inequalities baked into most data practices. A similar attitude is found in Latour, who argues that cartographic power is never fixed, but is 'a slow construction' (2011, 70) that can be corroded, interrupted or destroyed. The article builds on this ethos and examines how mapping can be reconfigured to produce alternative visibilities and power relations by drawing on the concept of intersectionality and seven principles put forward by data feminism: Examine power, challenge power, elevate emotions and embodiment, rethink binaries and hierarchies, embrace pluralism, consider context, and make labor visible (D'Ignazio and Kleing 2020, 17-18).

Engaging with visualization as a site of feminist intervention, the article examines how data feminist concepts such as 'intersectionality', 'emotion and embodiment', and 'power', can be used to reimagine mapping within planning. It does so, as discussed next, by drawing on three ways of framing visualization work.

Visualization as a site of innovation

Within visual methodologies literature, scholars like Niederer and Colombo (2019) propose to see visualization not simply as an output, but as a *process* of analytical exploration. Data visualization, they suggest, is about more than displaying results once they are found. Instead, visualization is instrumental in arranging and rearranging data materials for analysis. On this, Niederer & Colombo write: 'visualizations are not used to form the esthetic culmination of analytical work, but are rather functional tools for digital research (...) from its formulation and operationalization to the engagement of a broader public' (2019, 43). As this article will demonstrate, different ways of designing maps open spatial data up to certain interpretations, while closing or disabling others. To challenge the ontological security of maps (Kitchin and Dodge 2007), a feminist approach to mapping entails actively engaging with visualization as a process and series of design choices that always operate at the dialectic of inscription and erasure. A processual approach to visualisation is incorporated here by discussing and opening design choices up to critique, as opposed to taking for granted or normalizing them.

Within recent STS literature, scholars like Jensen et al. (2021) discuss visualization as a form of 'Participatory Data Design', proposing that data visualizations can be mobilised in participatory settings as an elicitation device that prompts participants to vocalize and explicate assumptions and perceptions about an issue. The way we arrange spatial data and bring it back to participants in workshops, in other words, frame what kind of discussions can be opened and how they unfold. Innovation of visualization strategies is therefore key to thinking critically about what kind of engagement we make possible in participatory GIS projects. As exemplified in this article, it is for instance important to consider if participants in a participatory GIS project are trapped within spatial framings that are pre-defined by researchers or are able to push back on and redraw spatial boundaries to match their experiential reality.

Third, data visualization scholars emphasize that visualizations, and maps in particular, wield a tremendous amount of rhetorical power as inscriptions (Bravo, Rufs, and Moyano 2022; Williams 2020). It does not matter how inclusive and diverse the data collection is if we continue to aggregate and display data according to standardized and simplified binary categories that cannot grasp the complexity and nuance of urban issues and experiences. To challenge this, D'Ignazio et al. (2021, 5) underscore experimentation as imperative to a feminist approach that asks speculative 'what if' questions and explores alternative ways of visualizing urban issues in efforts to challenge, question and subvert established visual conventions (Kennedy et al. 2016).

Drawing on this, the article takes a *processual*, *participatory*, and *experiential* approach to rethinking visualization practices within participatory GIS. Specifically, three research questions are explored: (1) Which visual techniques can make intersectionality legible in relation to mapping urban experiences? (2) How do we situate the framing of urban issues in lived experiences? (3) What visual strategies can be used to make blind spots and privileges among urban planners empirically visible?

Methods and materials

Co-funded by Innovation Fund Denmark, Aalborg University, Amsterdam University of Applied Sciences, IT University Copenhagen, and a Danish planning studio, the Urban Belonging Project was carried out in 2021-2022 by a collective of researchers and practitioners across Copenhagen and Amsterdam with the shared mission of studying how different marginalized communities experience belonging. While the process is visualized in Figure 1, the engagement, data collection, and analysis is introduced next.

Engagement process

To include a diversity of perspectives, the project engaged seven marginalized groups, including physically disabled, mentally vulnerable, LGBT+, deaf,



Figure 1. A diagram of the process in the Urban Belonging Project.

ethnic minorities, international expats, and homeless people, inspired by the data feminist principle 'embrace pluralism' (D'Ignazio and Klein 2020, 125), which proposes that nuanced insights come from synthesizing multiple perspectives, with priority to experiential ways of knowing, while involving affected communities in all stages of a data project.

To do so, we partnered with local organizations that represent each group: Danish Handicap Association, Danish Deaf Association, LGBTQ+ Denmark, Mino Danmark, SIND Danmark, Hugs & Food. We involved them *via* early stakeholder interviews in defining the project's questions and process, which centred around two issues: First, the project aimed to produce new insights about when, where, and how members of the involved communities experience belonging in the city. Second, it sought to contribute inclusive approaches to participatory planning that empowers and involves more diverse voices in debating urban issues.

To engage participants, we built on the trust that each community organisation has with its members, and used their connections (e.g. newsletters, social platforms, flyers) to invite participants to join the study, requiring only that participants self-identify with one or more of the invited communities and live in Copenhagen. To cultivate sensitivity to intra-group differences, we encouraged community organizations to sample with variation among their members. In total, 32 participants were signed up after an individual on-boarding process in which researchers explained the project, aims, and process to each person. Participants who identified with several of the involved communities were asked to choose which community they wanted to be grouped with during the first workshop, where we sought to bring people together with others who share at least one aspect of their identity. An overview of participants within self-assigned groups is given in [Figure 2](#)

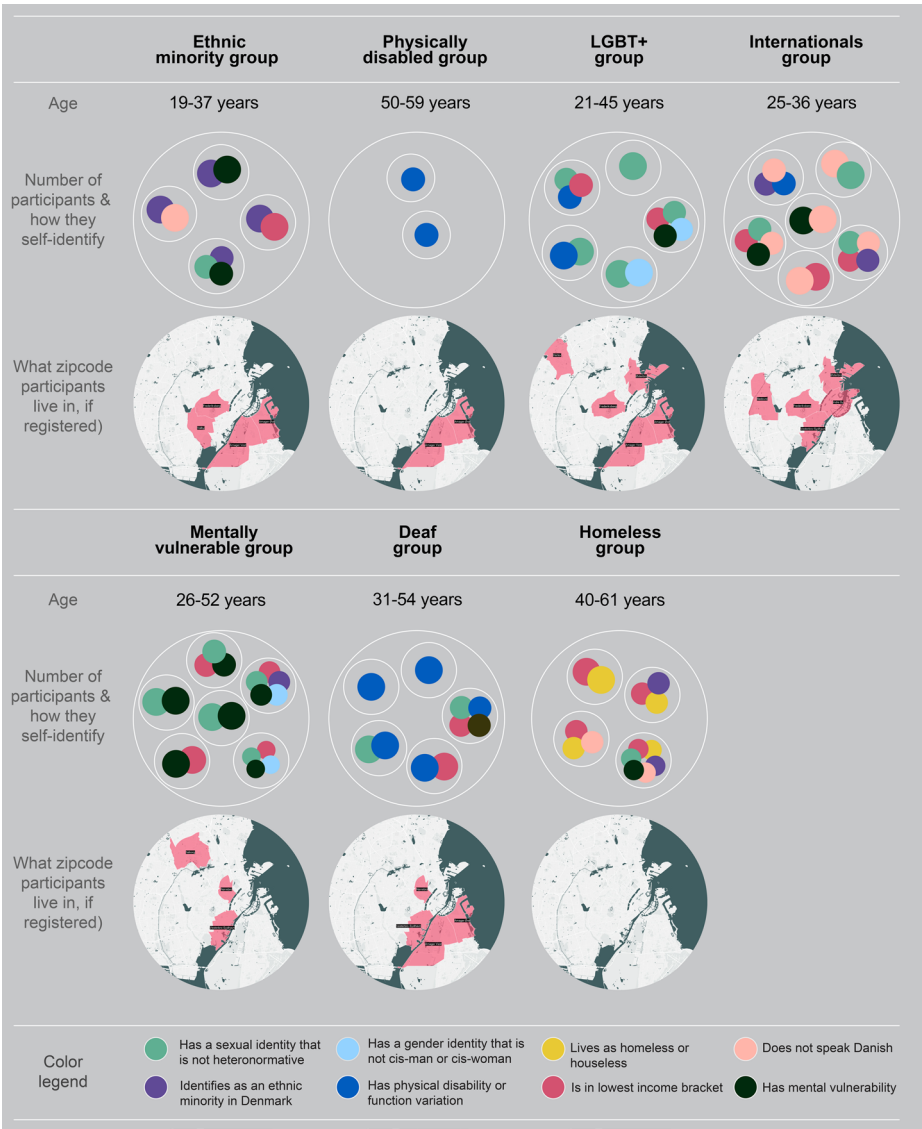


Figure 2. Overview of participants in the project.

with attention to age span and where they live in the city (not reported for homeless participants). The figure also displays how each person self-identifies according to a set of minority statuses, revealing that 27 out of 32 participants identify with multiple forms of marginalization. More on this in the results.

Data collection

Over a three-week data collection phase, participants were invited to use a combination of photovoice (Wang and Burris 1997) and participatory GIS

(Elwood 2006) to document their experiences of belonging in Copenhagen. The article at hand focuses solely on the use of participatory GIS, while the use of photovoice (Burgos-Thorsen, Niederer, and Madsen 2024) and development of a photovoice app (Madsen et al. 2023) is documented elsewhere. To contribute data, participants were asked to fill out a spatial questionnaire with Maptionnaire; a web-based tool that creates questions that participants respond to by drawing points, lines, and polygons on maps, while qualitatively annotating with sentiments, comments, or keywords. The survey asked participants to self-identify according to a variety of demographic parameters, providing up-to-date categories to choose from, while always also giving participants option to write their own words, or decline to answer. It then asked what keywords they would use to characterise Copenhagen and what keywords they associate to 'belonging', before asking to rank the degree to which they feel belonging in their neighborhood specifically and in Copenhagen at large. Spatial questions asked participants to map how they move around the city, what the routes they like or dislike, the places and areas they often visit, to map positive and negative experiences of belonging, to rank the perceived inclusivity of neighbourhoods, and more. Finally, it asked how much participants feel like they have influence on the way the city is being developed.

To mitigate data ableism (Charitsis and Lehtiniemi 2023) and digital literacy issues, the survey was introduced in small groups, where researchers brought computers, instructed participants on how to fill it out, and assisted people with disabilities or other barriers. Participants were instructed not to map where they live, sleep, or work to protect anonymity and prevent creating visibilities that can lead to harm. Collectively, participants produced 471 spatial datapoints in the survey.

Data analysis: collaborative workshops

The process was designed for participants to lead data analysis and to grow understanding within and across the seven groups by bringing participants together in different constellations in two workshops (see Figure 3). This choice heeds calls from D'Ignazio & Klein to shift away from 'doing good with data' to 'data for co-liberation' (2020, 140), which entails a process that gives leadership to minority groups, ensures ownership by community members, and ground-truths data in community-led analysis.

In the first workshop, we grouped participants based on the community group they had signed up with. Bringing groups together in which everyone shared a particular identity (e.g. being LGBTQ+ or deaf), created a sense of safety and led to participants unpacking detailed stories about their lived experiences, trusting other's ability to understand or echo it. In the second workshop, we regrouped participants based on overlaps among participants



Figure 3. Photos from workshops with collaborative mapmaking exercises.

who had taken photos during photovoice in similar areas, putting people together who shared a relationship to the same parts of the city, encouraging more site-specific dialogues. Participants hereby collaborated in different constellations across the two workshops on interpreting, contextualizing, and narrativizing data to unpack both *identity*- and *site*-specific experiences and issues that relate to the question of belonging.

In both workshops, researchers brought printed versions of spatial data created by each person in Maptionnaire and used them as elicitation devices, prompting discussion about belonging, mobility, safety, accessibility, and other topics, inviting participants to synthesize individual data in collective maps. Here, researchers worked as facilitators, while participants drove the analytical process by selecting, filtering, annotating, drawing, and redrawing maps in analogue ways. The visualizations presented here are re-digitized results of this process. They tell individual and collective stories about Copenhagen from diverse perspectives and foreground issues brought up around spatial frames, intersectionality, and power, as we shall see next. In 2022-23, these were exhibited at Copenhagen Architecture Festival and Ars Electronica, where the project received the 2023 EU Citizen Science Award.

Results

The following three sections put forward distinct visualization strategies for incorporating data feminist principles in participatory GIS. These strategies or 'provocations' trouble visual conventions in mapping and demonstrate how it is possible to; (a) craft an intersectional mapping vernacular; (b) situate urban issues in lived experience; and (c) make blind spots among urban planners

legible, while reflecting on the data feminist implications of such strategies for participatory GIS.

Provocation one: craft intersectional visualizations

To create more diversified insights into cities, it is not enough to redraw spatial divisions. It is also crucial that we create visualizations that break with binary and hierarchical representations (D'Ignazio et al. 2021). Think for instance about how many times you have seen a map with dots on it coloured red and blue, representing 'men' and 'women'. Such maps do not only produce a binary representation of gender that exclude many people. They also propose an isolated view of gendered issues encouraging planners to address social problems as stand-alone issues, without sensitivity to how gender intersects with other identities in shaping people's experiences. With the emphasis on intersectionality and the principle of 'rethink binaries and hierarchies', D'Ignazio and Klein (2020, 7) encourage the project's next provocation: craft an intersectional mapping vernacular that enables us to grapple with inter- as well as intra-group differences and show how urban experiences are shaped by intersecting forces of privilege and oppression. In the Urban Belonging project, this was essential as 27 out of 32 participants self-identified as marginalised in more than one aspect, calling for a holistic approach to representing their identities and experiences. While an intersectional tradition is well developed within fields such as qualitative GIS, feminist GIS, and counter-mapping, the intersectional analysis most often is enabled by a qualitative reading in projects with maximum 10-20 participants. But do we do, when we have more than 30 participants and there are 100s or 1000s of datapoints as in our case? How do we operationalize intersectionality when visualizing urban datasets? We explored this in the Urban Belonging project in three ways. Note, none of these propose a grand solution to visualising intersectionality. They are speculative, meant to expand our collective thinking and raise discussion about the implications of visualization for what modes of knowing are made possible (is why they are called 'provocations').

As a first experiment, we used alluvial diagrams to visualize participants identities as interconnected streams, as seen in [Figure 4](#). Using demographic information, the alluvial diagram plots each person as a wave line across vertical axes that represent different self-reported aspects of their identity. Each participant is plotted as one line, with line weight representing how many participants identify in some way.

In the figure, all participants are plotted with light grey. Exemplifying how to read it, two lines in [Figure 4](#) highlight a participant in the homeless (black line) and deaf (white line) group, tracing how their identities are comprised. This opens for discovering that although the two participants might initially

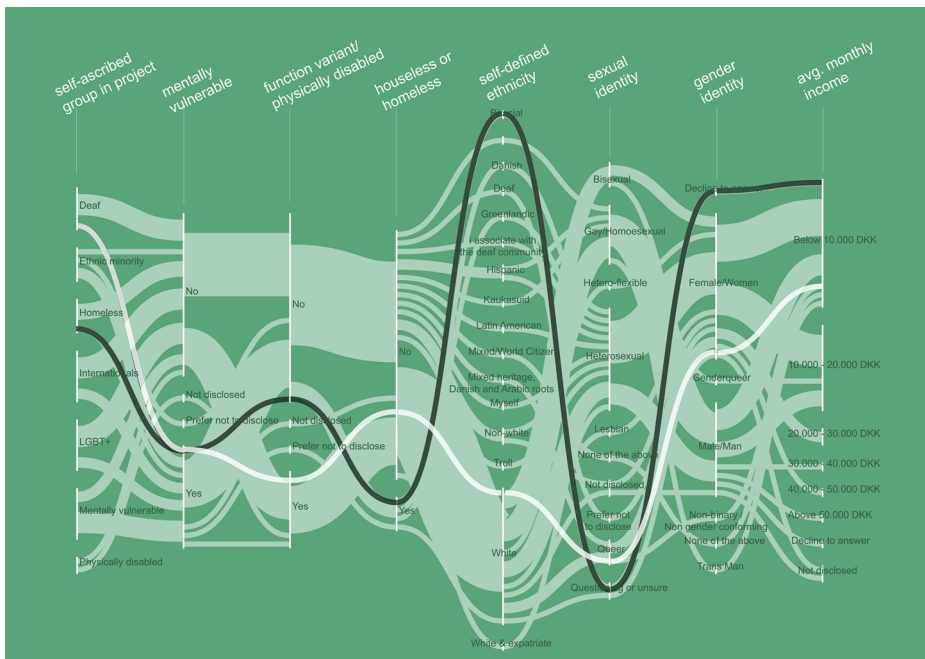


Figure 4. Alluvial diagram plotting participant identities across eight parameters. Each line represents one participant and how they self-identify. Line weight indicates the number of participants that identify in a particular way. Two lines (one white one black) are added by the author to highlight two different participants in the diagram.

seem different, they both identify outside the heteronormative, as being mentally vulnerable, and in the lowest income bracket. This visualisation technique hereby opens for seeing differences and similarities across and within groups. This type of diagram forces us to see participants as full human beings and can help urban planners and policymakers understand with more nuance who they design for and what shapes people's urban experiences.

As a second exploration of visualizing intersectionality, we created maps that examine how the *number* of marginalized identities comprised within each participant affects their use of the city. **Figure 5** shows an exploration of this, displaying 'places often visited' plotted by the 32 participants in the Urban Belonging Project. In the map, colours of datapoints indicate which of the community groups a participant has signed up with, while shapes of datapoints are used to indicate for each participant behind a datapoint, how many marginalized identities they hold at once. Places mapped by participants that identify as marginalised in one way are shown as circles, while a cross, triangle, square, pentagon, and six-tacked star is used to indicate that participants hold 2, 3, 4, 5, and 6+ marginalized identities at once, according to self-reported data.

The map shows that people who identify as marginalized in just one way (circles in the map) use a geographically larger part of the city. We see 'places

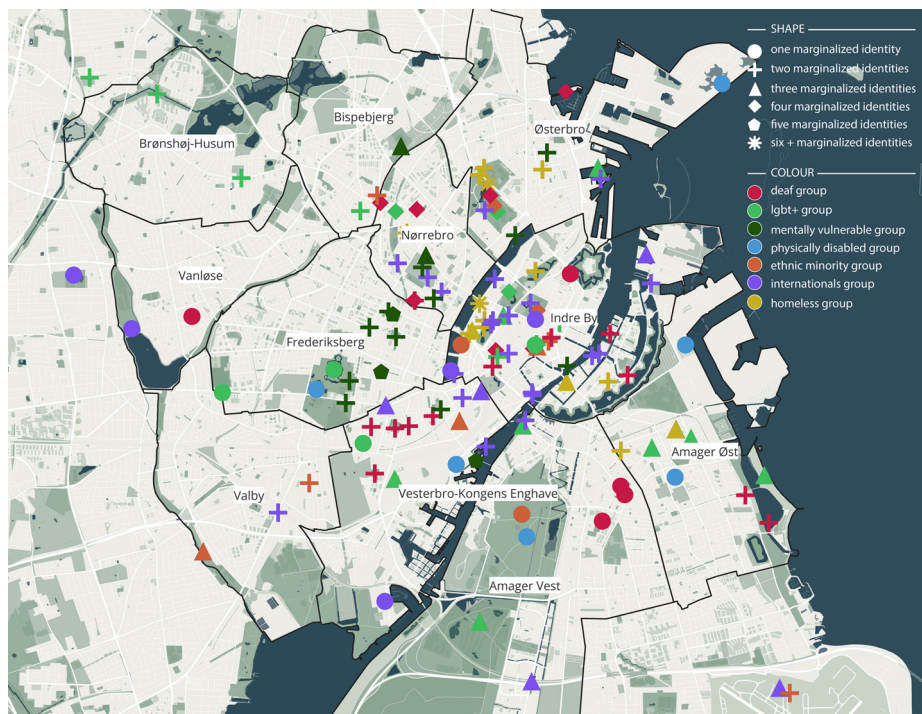


Figure 5. Map of places frequently visited, reported by each participant. Colors of points show participants' community groups, while shapes (circle, cross, triangle, square, pentagon, and star) indicate number of marginalized identities (from 1 to 6+).

frequently visited' by further out from the city center, while participants with many intersecting marginal identities (the square, pentagon, and star symbols) have plotted points in a smaller part of the city. This was also discussed in workshops, where Henrik, explains:

Sitting in a wheelchair and being queer means that there is no place for me in Copenhagen. If I go to gay bars, I cannot get in, and if I go to places with good accessibility, I don't feel at home as a gay man. I don't belong anywhere.

Another participant mirrored this experience:

As a queer and deaf person, there are very few places in the city where I feel at home. The queer bars in Copenhagen are always found in dark alleys, have no lighting inside, and are impossible to orient yourself in when you depend entirely on your vision

Such stories, paired with the map in [Figure 5](#), unpack how different spaces in the city work in excluding ways for people with multiple marginalized identities and make it clear why intersectional approaches to urban planning are needed.

As a third visual exploration, we combined mental mapping (Lynch 1960) exercises with self-reported information about how participants identify to display how intersectionality impacts people's perception of access in the

city: In Maptionnaire, we asked participants to draw a shape on a basemap to indicate what 'Copenhagen' is to them. Next, we added colours to polygons, using particular colors to indicate what forms of marginalization participants identify with. For example: Blue was added if a person identifies as physically disabled, and purple if they identify as an ethnic minority in Denmark. The result is seen in [Figure 6](#). More colours mean that a person holds multiple marginalized identities, creating gradients that flow together to show how uniquely assembled every identity is, and that it is impossible to separate different aspects of a person's identity.

The shapes reveal that for some the city boundaries spread wider, while for others, their idea of 'Copenhagen' is a lot smaller. This may not only reflect differences in perceptions of the city but also differences in privileges and access to the city. The figure, moreover, invites the reader to compare colour gradients within and across groups. Looking *across*, we find participants in all groups with multi-marginalized identities (since a participant in the LGBT group identifies as physically disabled, intersecting marginalizations are also found in this group). If we compare mental maps *within* groups, we further see that identities do not look the same. Studying the homeless group, for instance, we see that several participants also struggle with mental vulnerabilities. Yet, this is not the case for all homeless participants. Finally, the gradients with one color can be taken as an expression that some participants are marginalised in just one way. The purely blue polygons in [Figure 6](#) show that a handful of participants are deaf or have physical disabilities, while being privileged in other aspects of their identity (e.g. identifying as White, Danish-speaking, cis-gendered, heteronormative). From this, we can conclude three things: First, there are participants within all groups in the project who experience multiple intersecting forms of marginalization. Second, marginalization and privilege intersect to create intergroup differences among people who identify as part of the same community. Third, we cannot define a priori which combinations of marginalization are more frequent in shaping people's experiences. Instead, this is a contextual and empirical question. That is why we need intersectional strategies for mapmaking. The visualization techniques presented in this section propose just *some* ways to do this: Whatever strategy deployed, the provocation here is to design maps that enable an intersectional lens on cities.

Potentials and dilemmas

Bravo, Rufs, and Moyano (2022) emphasize that an intersectional visualization language is key to introducing nuance and liberating marginalized groups from tokenized representation. Visualizing intersectionality, however, there is no straightforward approach and every design choice warrants discussion. Reflecting on the implications of the visualization strategies in [Figures 4, 5, and 6](#), it is for instance essential to interrogate the tension involved with

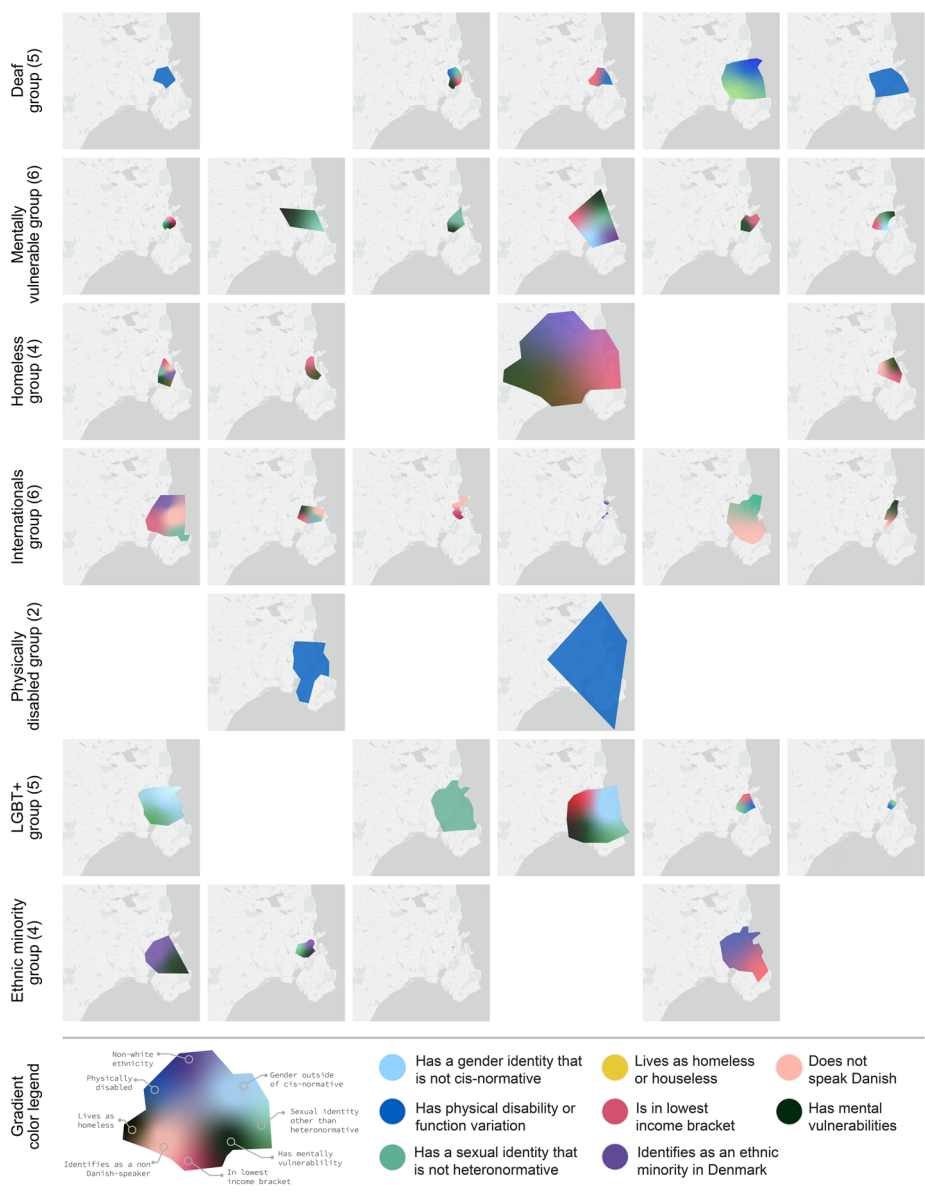


Figure 6. Intersectional data portraits of participants. Polygons show mental maps of Copenhagen, according to each participant, filled with one or more colours to indicate the particular marginalized identities held by a participant.

categorisations of data, since for many qualitative researchers their approach to intersectionality is about not reducing people to categories. This is not the strategies taken in Figures 4, 5, and 6, where the point of innovation is rather to radically rethink *how* we categorise. The mental maps in Figure 6, for example, plot identities against the ‘norm’; an able-bodied, Danish-speaking, White hetero-cis person without mental illness, homelessness, or low income. By doing so, do we risk further ‘othering’ the people, whose stories we seek

to elevate? The strategy taken in [Figure 6](#) involves giving visibility through colors to those, who are often invisible in the datasets, while making the 'normal' person invisible, thus subverting hierarchies of visibility. [Figure 6](#), moreover, uses bright colours to celebrate difference, inspired by Crenshaw who writes that '(...) the social power in delineating difference need not be the power of domination; it can instead be the source of social empowerment' (1991, 1242). Yet, it could be argued that we should stop categorizing people altogether, appreciating that identities are fluid, co-constitutive and contextual. But as D'Ignazio & Klein argue, there is no untangling of data from classification: '(...) the flaw in that plan is that data must be classified in some way to be used. In fact, by the time that information becomes data, it's already been classified in some way' (2020, 103). Bowker and Star (2000) similarly emphasize that the problem is not classification itself, but rather when classification systems become naturalized and we stop questioning them. The intention with the visualizations in this section is therefore not to do away with categorisation, but to show that we can categorise and design differently, with intersectionality in mind.

In doing so, the diagrams in [Figures 4, 5, and 6](#) also heed the data feminist call to 'embrace complexity' (D'Ignazio et al. 2021, 12), by creating visualizations that show how varied, interconnected, and multi-faceted identities are. A similar strategy is found in the Anti-Eviction Mapping Project (Maharawal and McElroy 2018), which maps evictions in San Francisco and break away from Edward Tufte-inspired conventions that visualizations should reduce complexity, be easy to read, and avoid occlusion. This design strategy is praised by D'Ignazio et al. (2021), who write:

The point is just this: there are too many evictions. The point is literally just to overwhelm you and, in a way, confuse you and force you to say: "Well, how could this be? Why are there so many points?" (2021, 11).

Similarly, the strategy of the visualizations in [Figures 4–6](#) is to show that participants' identities are complex and not easy to read, forcing planners and researchers to realise that simplified, tokenized, and universalised framings no longer serve us, if we wish to create policy and design solutions for all people.

Provocation two: situate spatial frames in lived experience

Exploring what it means to belong in the city, the Urban Belonging project also took inspiration in the data feminist principle of *elevate emotion and embodiment*, which invites us 'value multiple forms of knowledge, including the knowledge that comes from people as living, feelings bodies in the world' (D'Ignazio and Klein 2020, 73). Extending Donna Haraway's notion of 'situated knowledges' and problematization of the god-eye's-trick as an illusion of



Figure 7. A tableau of 32 choropleth maps showing how each participant ranks the inclusivity of Copenhagen's neighbourhoods on a scale of 1 to 5.

neutral and objective data, D'Ignazio and Klein (2020) invite us to embrace the subjective, partial perspective and to leverage rather than resist emotional experiences. A first attempt to incorporate this in the project came from asking participants to rank from 1 to 5 how inclusive each of the neighbourhoods in Copenhagen is to them, based on their perceptions. Instead of aggregating all answers into an average score for each neighborhood, losing the complexity and detail of each participant's perception of the issue, Figure 7 shows a tableau of all 32 individual maps.

The maps in Figure 7 suggest that the city's neighbourhoods are perceived very differently by participants, as no two maps look the same. Diving deeper, it is noticeable that Inner City is particularly contested as this area is ranked by many participants as *most* inclusive, and by others as *least* inclusive. In workshops, participants were asked to unpack this, and explained:

Inner City belongs to nobody. It lacks the specificity that makes certain groups belong there. When a space is for 'everyone' it becomes unpredictable. You can't know why others are there.

I feel uneasy about the spaces of Inner City without identity. Spaces for everyone essentially are for no one. There are no rules or intentions for how the space should be used, or who it is for.

These stories bust the myth of all-inclusive spaces, suggesting that no place can be universally inviting to all. Instead, most participants articulate that they feel belonging in spaces with a clear ownership that invites them in, while excluding others, even if this ownership is not permanent:

Nørrebro is the only place I feel home, because here I will never be the only person of colour, or woman with brown hair. There is a community of people like me.

I normally don't feel at home in the inner city. But when there is Pride, this part of the city changes ownership and becomes for me.

When designing for diversity, planners typically aim to create spaces that are inclusive to everyone. But what these stories demonstrate is that belonging emerges in a complex inclusion/exclusion dynamic and that belonging is not cultivated in generic identity-less spaces, but from designing for community and ownership. But while the maps in [Figure 7](#) helped unfold this, they also raised another issue: Most participants commented that it was arbitrary to rate the inclusivity of neighbourhoods because the boundaries separating them do not resonate with how they experience the city. A participant said: 'Inner City feels completely different than Christianshavn to me although they are in the same polygon in the map'. Participants hereby challenged the borders in [Figure 7](#), stating that it was not meaningful to report their experiences within these spatial frames.

Taking seriously the data feminist credo of elevating subjective realities and embodied knowledge, this leads to the project's first provocation: Let lived experiences of an issue define how it is framed spatially and use subjective experiential realities as valid topographies in mapping projects (Madsen, Grundtvig, and Thorsen 2022). To explore this, participants were asked to plot negative (red dots) and positive (green) experiences of belonging in Copenhagen in Maptionnaire. The result is seen in [Figure 8](#). With QGIS, a K-means clustering algorithm has been run to identify spatial clusters with a high density of positive and negative experiences. A Concave Hull algorithm was used to draw these as 'zones of belonging' (green polygons) and 'zones of exclusion' (red polygons), while still displaying the individual experiences that clusters are calculated from.

The map exemplifies how participatory GIS can be used to draw bottom-up maps that ground spatial divisions of the city in problem-specific lived experiences. It produces a new topography and shows that zones of belonging and exclusion cut across administrative divisions of neighbourhoods (blue lines). Interestingly we see zones of belonging often overlapping areas with parks or waterfront. Investigating this closer, 59 out of 117 positive experiences (50,4%) fall inside or close to a park or waterfront, while only 9 out of 64 of negative experiences (14%) do. This could indicate that experiences of belonging are connected to nature, especially since red zones B, C, D, and E constitute areas with little to no parks and waterfront. The map also reveals that Inner City is the most contested area, with 'belonging zone' A overlapping the 'exclusion zones' X, W and Z. Whereas [Figure 7](#) forced participants to report their experiences within official neighbourhood borders, the bottom-up mapping in [Figure 8](#) hereby captures more nuance in participant's ambivalent relationship to Inner City and allows us to break this area up into

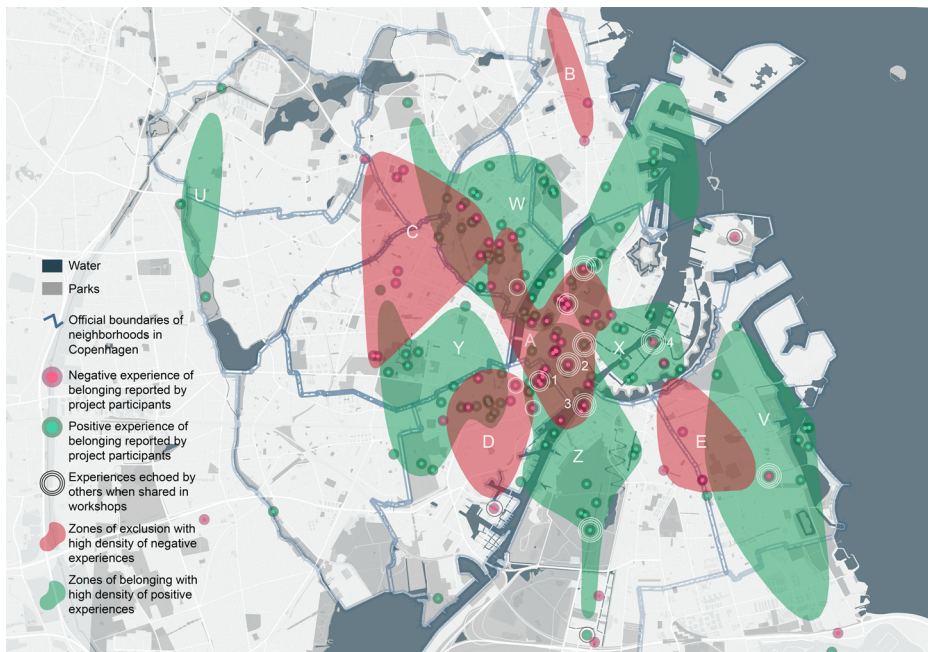


Figure 8. Positive and negative experiences (green and red dots) in Copenhagen plotted by participants, layered with 'zones of exclusion' (red polygons) and 'zones of belonging' (green), drawn with K-means clustering from the spatial density of points.

different zones. This could inform where researchers do site visits, where planners make interventions, and add important nuance to policy initiatives. Meanwhile, the high density of red dots in zone A, indicates that this area is not just made up of a few negative experiences, but many. To unpack this, participants were asked to select one of their experiences from the map and present it to others in their group. Noticeably, experiences shared in all groups, especially by young people, revolved around discrimination in the nightlife within 'zone A', as exemplified here:

For deaf people there are many negative experiences in the nightlife: You are kicked out because the doorman thinks you are making trouble, when you don't hear them. Or someone is physically violent to you [*1 in the map]

A group of young men rolled up in a car when I was walking and threw trash at me, yelling "faggot." When you have an episode like this, you don't forget. I feel unsafe as an LGBT person in these spaces with lots of random, drunk people pass through [*2]

Other stories revolved around accessibility and feelings of exclusion:

As a homeless person, I feel like I am not allowed to be. It is difficult to find a place to just sit and rest or eat food. The parks are my refuge, but most of the city is not for me [*3]

In the deaf group, a participant shared a related, yet different experience:

This bridge is too crowded. As a deaf person I cannot hear when people on bikes ring their bell and want to pass me. It is stressful. I feel unsafe and like I am in the way [*4]

These stories produce layered narratives about how the city works to exclude marginalised groups and exemplify that by re-drawing the map from lived experiences, it is possible to unpack embodiment and emotion. The can help discover new relationships between an issue like belonging and the physical environment and ground-truths the spatial framing of the issue in light of how it is experienced by people.

Potentials and dilemmas

With reference to Gayatri Spivak, D'Ignazio & Klein argue that data projects carry a risk of epistemic violence, when 'the people doing the work are strangers in the dataset, when they are one or more steps removed from the local context of the data' (2020, 147). In response to this, a data feminist project should involve participants in all stages, including data analysis. As we saw in this section, the involvement of participants in interpreting the maps in [Figure 7](#) was key to letting them challenge the ontological security of spatial categories such as neighbourhood borders and creating the map in [Figure 8](#) as an alternative that re-situates spatial divisions of the issues of belonging in participants' lived experiences. This exemplifies, what Thylstrup & Veel describe as making 'dissent' possible:

A visualization is often delivered from on high. An expert designer or team with specialized knowledge finds some data, does some wizardry and presents their artifact to the world with some highly prescribed ways to view it. Can we imagine an alternate way to include more voices in the conversation? (2017, 71)

Meanwhile, this mapping strategy does not come without dilemmas of its own. It could be critiqued that the use of a base map forces participants to conform to a Cartesian representation of space that carries in it inherently colonial, exploitative legacies. A radically de-ontologized approach to mapping would perhaps replace 'scale mapping', where participants are asked to locate experiences with geographic accuracy, with sketch or ephemeral mapping. Participatory GIS, however, proposes that there can be empowerment in using standardized mapping techniques because it ensures commensurability: 'Project teams turn to GIS because it allows them to speak to policymakers using the authoritative voice of maps' (Gubrium and Harper 2016, 167). The strategies proposed here adhere to this and use scale mapping to let communities map experiences in spatial terms that planners and policymakers will recognize and accept. Meanwhile, they refuse to aggregate data within pre-defined units and offer spatial frames that are situated in lived embodied, and emotional experiences.

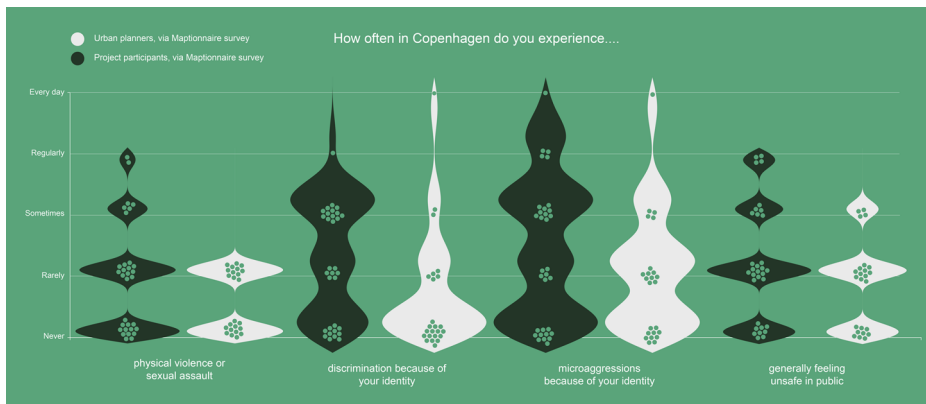


Figure 9. Diagrams showing group-level trends (violins) and how often (individual dots) planners (white) and participants (green) report experiencing physical violence, discrimination, microaggressions, and feeling unsafe in the city.

Provocation three: make blind spots legible

Data feminism begins from acknowledging that power is distributed unequally in the world: 'Those who wield power are disproportionately elite, straight, white, able-bodied, cisgender men from the Global North' (D'Ignazio and Klein 2020, 8). Design Justice, outlined by Costanza-Chock, extends a similar critique: 'Professional design jobs in nearly all fields are disproportionately allocated to people who occupy highly privileged locations within the matrix of domination' (2020, 73). Consequently, it is often recognized that designers unconsciously default to imagined users whose experiences are similar to their own and have a profound inability to imagine the needs of more diverse groups, identify existing problems in the world, and imagining possible solutions to them (D'Ignazio and Klein 2020, 29). Yet, these blind spots continue to be theoretical and are rarely examined among planning professionals. The data feminist principles 'examine power' and 'challenge power' (D'Ignazio and Klein 2020, 17) encourage us to upset this attitude. To do so, this article proposes that participatory GIS can be used not just to reconfigure who is *doing the mapping*, but also to subvert *who is being mapped*. As an experiment, 24 urban planners from a global architecture studio in Copenhagen agreed to fill out the same Maptionnaire survey that project participants had taken, creating opportunity for comparing data. Figure 9 compares how frequently the planners and participants respectively report having had various negative experiences in the city.

The violin diagrams in the figure show that a higher number of project participants sometimes, regularly, or everyday experience physical violence, discrimination, microaggressions, and feeling unsafe in public spaces, compared to the planners. When asked how inclusive they think the city is for all people on a scale of 1 to 5, the professional planners also on average rank

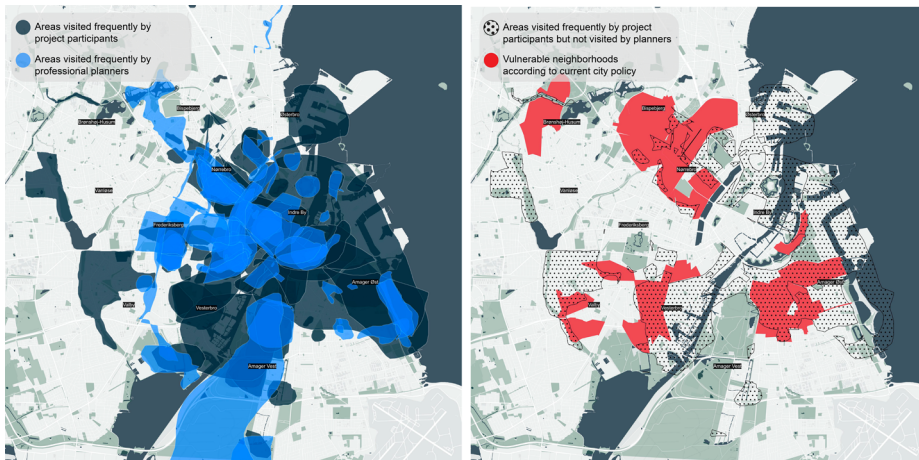


Figure 10. Left: Map of areas frequently visited by planners (blue) and participants (dark blue). Right: Map of areas frequently used by participants, but not planners (scratched), layered with 'vulnerable areas' (red) as per official municipal policy.

Copenhagen higher (3,4) than the participants (3,0), making clear that planner's privileged position in the social hierarchy affects a different and more positive perception of how inclusive the city is, compared to project participants. To unpack this spatially, Figure 10 compares 'frequently visited areas' drawn by planners (blue) and participants (dark blue) in the map to the left. The scratched layer in the map to the right in Figure 10 juxtaposes these by using QGIS to cut out overlaps and show the planners' blind spots; areas that are frequently visited by project participants, but where none of the professional planners report going.

The map shows that the planners are very particular about what areas of Inner City, Vesterbro, Nørrebro, Christianshavn, and Amager they visit, which often overlap with gentrified parts of these neighbourhoods and areas with proximity to green parks and waterfront areas. Meanwhile, project participants frequently use areas of the city that are further away from the centre, which the planners do not. Interestingly, the red parts of the map in Figure 10 show that areas frequented by participants but not visited by planners often correlate with areas that are deemed 'vulnerable neighbourhoods' by the municipality and defined as sites of intervention (Teknik- og Miljøforvaltningen 2017). If these areas are subject to urban renewal, the blind spot map could be used to examine what local knowledge is held (or not held) by the planners involved in the design.

Potentials and dilemmas

Blind spot mapping could potentially be used to select places in the city that warrant site visits by planners and could be essential to fostering a culture of accountability and transparency among designers and policymakers.

Meanwhile, this sort of mapping also brings with it new challenges and questions. When data feminist principles encourage us to ‘examine power’ and ‘challenge power’ (D’Ignazio and Klein 2020), it is important to turn attention to those who professionally work with designing cities and study how this group’s privileged positions influence how they see the city. Yet, we must find ways of doing so, without flattening the representations we create, or potentially misconstruing or polarizing the picture. In the Urban Belonging Project, several of the participants from marginalized groups study or work with cities in some capacity, and although most of the professional planners included in this mapping are a homogenous and privileged group of people, 8 out of 24 identify as marginalized in some way. To avoid creating harmful exposure and visibilities, it is important to discuss such nuances and avoid creating false distinctions between professional planners and marginalized communities as two mutually exclusive groups. When mapping blind spots of urban designers or other professional groups who are assumed to have privileged positions, we should embrace greater complexity: Within the assumed dominant groups, minorities are also found, and within assumed marginalized communities, there are people with professional influence and power.

Conclusion

This article has interrogated the potential for incorporating principles of data feminism in participatory GIS and involving more diverse citizens in debating and framing urban issues. Documenting the Urban Belonging project, the article has used a data feminist framework to engage a pluralism of marginalized groups in mapping urban issues and involve communities not just in collecting, but also interpreting and analysing data. Specifically, the article has put forward three provocations for operationalizing a data feminist approach to visualization in maps. A first provocation insisted that we craft an intersectional mapping vernacular to diversify our understanding of the people we are designing for. A second provocation suggested situating the spatial framing of urban issues in lived experiences. Finally, a third provocation demonstrated that participatory GIS can be used to make blind spots among professional planners empirically legible.

Reflecting on the impact of these visualization practices in participatory GIS it is crucial to ask: Does mapmaking actually change planning outcomes? It has been questioned whether public participation projects really enhance planning outcomes or change decision-making (Brown, Weber, and de Bie 2015). To increase impact, at least two continuous challenges exist for participatory GIS: On one hand, there is a problem of *accountability*: Whenever marginalized communities submit their time, data, and stories, there is no community control over what agenda data is used to serve, and no accountability for how planners use insights to inform decisions. Because of that

participatory GIS has been shown to continue a top-down planning tradition and lead to ‘cherry picking’, in which data is misused to validate a priori assumptions and already made decisions (Kahila-Tani, Kytta, and Geertman 2019). Building accountability into citizen science is a design challenge we must take seriously. This relates to a second problem, namely what has been termed ‘*the problem with solutions*’ (Holmes 2024), characterized by the trend to plan cities through the prism of known solutions, letting solutions define the problem. Most participatory GIS projects invite citizens to validate already made decisions, not taking seriously the potential for letting citizens negotiate and reframe urban problems. If participatory processes are to have a greater impact, we need to move towards a ‘non-solutionist’ planning that allows the framing of a problem to precede efforts of solving it. In pursuing that, the operationalisation of data feminist principles in participatory GIS has a lot to offer, as demonstrated here.

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No competing interests to declare.

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Sofie Burgos-Thorsen is a sociologist and holds a Ph.D. in Design Justice, Data Science, and Urban Planning from Aalborg University and MIT. She has worked for 10 years in-between the architecture and tech industries across Copenhagen, New York, Boston, and more, with experience from the Techno-Anthropology Lab, Gehl Architects, Copenhagen Institute for Futures Studies, University of Copenhagen, and the Institute for Wild Problems (INVI), where she is Director of R&D. She strives to bridge research in AI, computational methods, GIS, counter-mapping, and visual methods with practices of planning and policymaking, exploring how participatory approaches can be used to involve local communities in framing societal issues.

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Data availability statement

Data holds sensitive information about people and is considered unsuitable to post.

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