

Diverting Water and Continuing Violence: Considering the fragile foundations of AI infrastructures in Colombia

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Abstract

Increased demand for Artificial Intelligence (AI) adoption in everyday life has expedited the construction of data centres globally, including in regions affected by conflict. Through ethnographic research in Colombia we shift attention from AI directly and learn from ground up understandings of water and digital infrastructures, in parallel with the relationality of gender and violence which surround them. This approach begins to expose the fragile foundations on which data centres may be built and use cases which are being proposed.

Keywords

Artificial intelligence, Infrastructure, Data centres, Ethnography, Environment, Conflict, HCI.

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1 Background

The exponential growth of generative artificial intelligence has led to a demand for the expansion of infrastructures which enable it. GPUs, data centres, cooling systems, power infrastructures and storage systems underpin the functionality of AI. The land and energy requirements demanded by AI infrastructures have gained attention across disciplines, particularly in understanding environmental impact such as carbon emissions, water use and mineral extraction [4, 25, 24, 27, 36, 45]. This writing acts as an intervention point by positioning ground up learnings on infrastructure, conflict and gender from over 4 months of research in Cauca, Colombia. By de-centring AI and focusing on everyday interactions with infrastructure and land, we can begin to challenge dominant narratives in existing literature to understand the fragile foundations which data centres may be being built upon. In the context of this research, Colombia has 38 data centres, 3 of which are in Cali [21] which is the neighbouring department to Cauca where this work took place. The

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expansion of AI infrastructures in Colombia comes with hopes of improved digital infrastructures and increased jobs through foreign investment [21] but there is room for research which explores the complex infrastructural foundations and gendered tensions which data centre construction is intertwined with.

1.1 AI infrastructures and beyond

Infrastructures can be broadly understood as ‘large-scale systems that support people’s routines’ [28]. The complexity of infrastructures has been explored beyond the physical elements considering the social and technical aspects of infrastructures [38], infrastructural breakdown [37, 22], and infrastructuring practices to enable the continuation of routines even when such systems are in a state of disrepair [15, 8, 13, 30]. Increasingly researchers have given attention to AI infrastructures. This research has expanded to understand how AI systems are embedded in global, extractive supply chains creating uneven geographical harm, through the exploration of de-colonial AI [32, 9, 41] and explorations of ‘compute sovereignty’ [20].

Beyond AI, HCI research has examined the social and technical complexity of infrastructural development in conflict-afflicted regions. In relation to the Colombian context, research has looked into the use of technology by FARC-EP and how the guerrilla group adopts both new and old technologies [7]. Research has also considered how infrastructural disrepair in contexts affected by conflict necessitate continuous practices of ‘security patchworking’ to maintain everyday security [30]. Additionally, HCI researchers investigated how Ukrainian refugees in Germany use IT infrastructures during war and flight [39]. Prior work in HCI and CSCW has established a foundation of knowledge on infrastructural availability and infrastructural breakdown and this now must be expanded to AI.

1.2 AI, scale and violence

Critical researchers are concerned that AI will lead to epistemic violence at scale reaffirming hegemonic power structures, neglecting perspectives from the global majority [17] which will maintain, ‘capitalist, colonialist and patriarchal order’ [35]. A burgeoning area of research on data centres has considered tensions in local communities in relation to health and water usage and noise pollution [33], and political responses and citizen mobilisations against data centres [5]. The American context has received attention in studies of water consumption and ecological limits of AI infrastructures in Chile [41], supply chain capitalism and geographic asymmetries in Mexico [43] and the rapid expansion of data centres in the US permitted through sociotechnical imaginaries at state and national level [46]. There has also been a pivot away from

global AI to 'local' and 'patchy' scales which highlight tensions in human and more-than-human AI systems [12]. This convergence of fields has also forged a path for exploring more environmentally responsible AI, referred to as 'green AI' [11], explorations of 'digital sufficiency' [16] or 'sustainable AI' encompassing social, environmental and economic facets [3]. Additionally, there has been a call to embrace data ecofeminist principles to examine power structures and consider frugal AI development and centre people and the planet [42].

1.3 Applications of AI in conflict and peace

Beyond questions of infrastructure, the application of AI in regions affected by conflict is ever expanding. Cross-disciplinary research into AI in military and warfare [18, 10] includes lethal autonomous weapons and decision making [26], AI enabled information warfare [19], and early conflict detection systems [34, 47]. Attention on the risks and challenges of AI technologies in conflict often surround ethics, accountability, algorithmic bias and data security and privacy yet proponents of such innovations cite accuracy, scaled interventions, early detection and reduction in polarisation as motivation, highlighting the 'paradox of AI' [6].

One proposed application for AI technologies is to enable scaled democratic dialogues and peace negotiations [2, 1, 44]. This body of work has developed alongside research which considers deliberative AI technologies [40] and the creation of new digital public squares for community dialogues [14]. Proponents of the application of AI to questions on peacebuilding and democratic processes suggest AI can help to find common ground on sensitive topics, such as the study on collective AI enabled dialogue between Israeli and Palestinian peacebuilders [23] and help expand participation, increasingly inclusivity [29].

2 Mini methodology

This work is informed by 4 months of ethnographic fieldwork in the city of Popayán, in the department of Cauca in Colombia, in 2024. Popayán is the capital of one of the departments most affected by the ongoing conflict in Colombia. The researcher was deeply embedded in Popayán through ongoing connections she had with friends and organisations in the city since 2019. She regularly attended, helped at and organised events and gatherings in the city and in areas nearby. She conducted 20 interviews with 29 participants. All of the interviews were in person and held in locations suggested by participants. The interviews were held with people either directly affected by the conflict or those who help people who have been. The majority of the interviews were conducted in Spanish and the researcher usually was accompanied by a friend and confidant who supported moments of language breakdown. The ethnographic data serves as the foundation for this intervention which is brought into conversation with related work to explore tensions between infrastructure, gender and AI development in regions impacted by conflict.

Condensed Positionality. As a woman from Northern Ireland I have an intimate interest in issues of information, security and gender in regions impacted by conflict. I have been visiting Colombia as a researcher and friend since 2019.

Condensed Ethical Considerations. The research received full ethical approval from our institution's Research Ethics Committee and procedures for obtaining informed consent were followed. Data minimisation was prioritised during data collection, transcription, analysis and presentation of the data.

3 Early findings

This paper shares a limited amount of fieldwork data to de-centre AI so we can understand the fragile infrastructural [water and digital] and relational foundations [violence and gender] that data centres are being built upon. These findings provides a foundation to provoke further research into the intersection of infrastructure, gender and violence in contexts of conflict when considering the development of data centres.

3.1 Precarity of water infrastructures

Water supply is an essential infrastructure that enables daily life. In rural areas of Cauca, labour was heavily gendered and a central aspect of women's work surrounded water for fishing and cleaning. Limited infrastructure existed and women went to the river directly for sources of food and to clean the clothes of their families. The water infrastructures which did exist diverted water from rural zones to more powerful geographic and economic centres, such as Cali the capital city of the neighbouring department of Valle de Cauca. One participant explained how water was diverted from the Salvajina dam in Suárez, Cauca to go to Cali. The diversion of water from the rural zones of Cauca was meant to generate energy for the whole south west of Colombia however, over a quarter of Cauca was yet to have any electricity coverage. The irony of water diversion from rural populations to a large city can be understood as structural violence against rural communities who are left without water infrastructures or stable energy provision. This particularly impacts women due to the gendered division of labour.

Additionally, clean water was not guaranteed due to the existence of mining in Cauca. While walking along a busy road in Popayán with one participant, we were looking at how people spoke out about social and environmental concerns through street art. Long wooden boards painted blue had been attached to the railings with the following text: "*Lo que consume de agua una familia en 20 años, lo gasta minería en una hora.*"[ES] "*What a family consumes in water over 20 years, mining uses in one hour.*"[EN] Such statements emphasised the imbalance of water usage in Cauca.

3.2 Limited digital infrastructures and unequal access

A significant infrastructure to explore in the Colombian context is the digital. Digital infrastructures did not cover the whole department of Cauca with many people having limited access to mobile signal or connectivity. The government had not invested in constructing infrastructure evenly across the region and the conflict led to tight control of development by armed groups, or the targeting of communication infrastructures. Also, the land and climate impacted the stability of the digital infrastructures which did exist. One participant shared: "*There is a landslide, then there is no energy. How are you going to maintain good communication if there is no energy or internet?*" The fragility of connectivity was evident and

further, the issue of access was also uneven. Women living in rural communities experienced multiple barriers to access in line with economic and gender factors. One participant shared:

“They don’t know how to use new technologies, they don’t have the economic capacity to access technology and they don’t even get an internet signal, or many times even a cell phone signal, so there is a very big barrier, which affects women to a great extent. Because well, a phone can reach the family. In the end, who is going to have it [a mobile phone]? The man who goes out more, and the woman who is often relegated to those private roles in the home, she does not have access to technology.”

Such layered barriers to digital infrastructures, beyond the instability of the infrastructure itself, further permit gender violence through exclusion. This should be taken into consideration in the development of data centres.

4 Early discussion

4.1 Fragile infrastructural foundations and continued violence

The findings reveal layered infrastructural and relational fragilities which together compose a precarious foundation for the development of AI infrastructures. The case of the Salvajina dam in Cauca, which generates energy for south-western Colombia while the surrounding municipality lacks electricity coverage, offers an example of the diversion of resources from rural communities through the lack of stable water and energy infrastructures to support everyday livelihoods. In conversation with research on data infrastructure development, the construction of AI infrastructures can lead to geographic asymmetries and deepen extractive relationships rather than remediate them [43]. For rural communities, often some of the most affected by the conflict, AI infrastructures can be understood on the continuum of violence as they play within interconnected oppressive systems that span the macro-political to the micro-relational [35].

The growing interest in data centre construction in Colombia, accompanied by promises of employment and digital development [21] evidences the delicate balance between infrastructural development and fragility. Hype around AI development builds upon ideas of the ‘spectacular’ in how technology development acts as a loud distraction from everyday mundane infrastructures and practices which surround them which enable people to continue daily routines in contexts of conflict [31]. This builds upon the call made by [12] to look at data centres from ‘local’ and ‘patchy’ lenses to break homogenous generalisations of the impact of such infrastructures and seek to understand the ‘uneven, situated, and often overlooked consequences of technological expansion.’ Further, by centring the fragmented foundations of infrastructures through understandings of infrastructural breakdown [38, 37, 22, 30] we can begin to understand the everyday tensions and unstable base which data centres are being built upon.

4.2 Whose voice is heard?

The findings begin to unpack how infrastructure and gender are intimately intertwined in Colombia. Participants described how mobile devices and internet connections, when they existed at all, were more likely to be held by men whose labour took them beyond the home. When linked to broader concerns that AI development may amplify the voices of those who already have access to technology while deepening the exclusion of those who do not [35] we can begin to critically explore what meaningful inclusion might look like if AI is used in contexts affected by conflict.

Increased participation is stated as a motivation for AI technology use in contexts of peace negotiation [29, 2, 44, 23]. Yet this cannot be considered meaningful if the infrastructures do not exist to support the incorporation of voices from those systematically excluded. If participation in AI-enabled dialogue requires consistent internet access, the access to a device, digital literacy skills and the freedom of movement to engage with technology beyond the domestic space, then the women of rural Cauca are likely to be structurally excluded before such tools are even deployed.

5 In summary

This work presents a starting point for the HCI community to pay attention to the fragile foundations of which data centres and AI infrastructures are being built upon in contexts affected by conflict. When factors of infrastructure, violence and gender are brought into conversation it serves as a reminder to work towards contextually informed AI development from a ground up perspective, which doesn’t further exclude those most affected by conflict.

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