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Social AI and Pro-Environmental Behaviour: A Qualitative Inquiry into the Influence of Chatbots and Virtual Assistants in Pakistan

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Abstract

The intersection of artificial intelligence and environmental communication has opened a relatively unexplored corridor of inquiry in developing economies. This qualitative study examines how social AI tools — specifically chatbots and virtual assistants — shape pro-environmental attitudes and behaviours among urban Pakistani adults. Situated within a constructivist paradigm and drawing on interpretive phenomenological analysis, the study engaged 24 participants recruited through purposive and snowball sampling across Islamabad, Lahore, Karachi, and Peshawar. Data were collected through semi-structured in-depth interviews conducted between January and April 2024 and analysed using reflexive thematic analysis. Six overarching themes emerged: (1) the role of conversational AI in environmental awareness; (2) normalisation of green behaviours through habitual AI interaction; (3) credibility and trust in AI-generated environmental information; (4) socio-cultural mediators of AI influence; (5) limitations and resistances; and (6) aspirations for context-sensitive AI. Findings indicate that AI chatbots and virtual assistants serve as meaningful catalysts for incremental behavioural change, particularly among younger, educated segments of the urban population, though their impact is constrained by infrastructural disparities, cultural norms, and algorithmic biases rooted in Western environmental discourses.

Keywords: Social AI, Chatbots, Virtual Assistants, Pro-Environmental Behaviour, Sustainability, Pakistan, Qualitative Research, Behaviour Change

1. Introduction

The swift integration of AI-driven conversational technologies into our daily lives has created new ways of accessing information that social scientists are still only beginning to investigate. Whether via a customer service robot or a voice-activated device in our homes, the use of what researchers term "social AI"-including chatbots, virtual assistants, and large-language model-based interfaces-is increasingly being integrated into everyday routines that have been exclusively human-powered until now. There is significantly less research on what, exactly, these tools can do to change people's attitudes toward and behaviour regarding environmental issues, and in what contexts, particularly outside of the highly technologized, high-income settings typically featured in the studies of social AI (Gupta et al., 2023; Liao & He, 2024).

The South Asian case of Pakistan is, by contrast, both poorly represented and particularly promising for investigation. With a population of more than 240 million people, Pakistan is among the most vulnerable countries to climate change impacts globally according to the Global Climate Risk Index, while it remains among the most rapidly emerging markets for smartphone uptake and social media usage in the region (Germanwatch, 2023; Pakistan Telecommunication Authority, 2024). In particular, young Pakistanis have rapidly adopted AI-enabled platforms such as ChatGPT, Google Assistant, and Siri for use in a variety of domains from academic work to entertainment. The question of whether this mass adoption actually leads to changes in what Pakistanis understand about environmental issues and the actions they take-or don't-in the face of them is critically underdeveloped in the current body of scholarship.

Several theories-such as the Theory of Planned Behaviour (Ajzen, 1991), the Information-Motivation-Behavioural Skills model (Fisher & Fisher, 1992) and more recent human-AI interaction models (Nass & Moon, 2022)-suggest that that personal and trusted information provision delivered via multiple, reinforced channels effectively influences intention to change behavior. Chatbots and virtual assistants provide personalized answers; their interactions convey warmth and simulate sincerity; and these devices are available on demand-perhaps in theory to be seen as credible, consistent, and warm sources of pro-environmental information. If this provides a conduit to increasing environmental concern and sustained green behaviour, then a variety of public health, public policy and communication-oriented consequences may emerge from this use of the technology.

Research conducted elsewhere in the South Asian region however reveals that access to technology in this context are subject to a set of conditions that temper simple technological enthusiasm (e.g., Alam & Uddin, 2023; Rehman et al., 2022)-namely digital literacy deficits, language barriers, inequalities in access to devices and infrastructure and prevailing cultural norms with regard to trust and authority. Additionally, since much of the data used to train the large language models that form the backbone of contemporary social AI platforms is drawn from Western contexts it is a genuine cause of concern whether ecological concerns prioritised or embodied in the interactions with AI are aligned with Pakistani values.

This study aims to explore these issues by taking an interpretative approach and prioritising the voice and experience of the participants in order to understand meanings that are constructed and created by adults in Pakistan through their interactions with chatbots and virtual assistants in relation to environmental concerns. A key element of this is the exploration of the process

by which interaction with these tools contributes, or does not contribute to changing individuals pro-environmental behavior attitudes.

The research questions guiding this study are:

(1) How do Pakistani adults describe their interaction with chatbots and virtual assistants in regard to environmental themes? (2) What mechanisms do individuals identify that are associated with AI interaction shaping their behaviour in more pro-environmental directions? (3) What contextual factors assist in, facilitate, or impede these influences?

2.Literature Review

2.1 Social AI: Definitions and Developmental Trajectories

What is social AI? Social AI is comprised of artificially intelligent technologies that are able to engage humans in conversation (ie; allow a dialogue to take place using natural language), simulating presence (providing a sense of presence for another) and maintaining that dialogue over longer conversations (Luger and Sellen 2016). It covers rule-based and retrieval- augmented and large generative models of chatbots and, while they vary significantly in their capabilities, they all share the same interface-namely, a conversational interface-a clear contrast to earlier kinds of technology information technology The advent of ChatGPT at the close of 2022 and a number of its iterations brought general interest to generativeAI to consumers all around the globe on a large scale (OpenAI, 2023).

Studies on human AI interaction, through social presence theory and using computers are social actors paradigm, have tended to address questions on why users communicate with such systems in the same ways as human interactants - ie, to communicate with artificial social agents, attributing to them agency, personality and emotions they never have. 25 This antropomorphism ofAIhas directly influenced study ofInfluence-insofar as AI is presented by the user as believable, trustworthy and familiar and in that capacity the recipient of

the users trust through, for example, a particular communication pathway of theirs or a media format (Kim and Sundar 2022).

2.2 Technology and Pro-Environmental Behaviour Change

The link between the usage of information and communication technology (ICT) and environmental behaviour have been theorised by multiple complementary frameworks. The Value-Belief-Norm framework (Stern, 2000) suggest that ecological values, beliefs of consequences and awareness of one's personal moral obligations drive pro-environmental behaviour.ICT's, in this context have traditionally been conceived as both potentially undermining or strengthening any of the proposed links between Value-Belief-Norms(Reisch and Sunstein, 2023).Various designs of digital nudging, customised feed and information curation as well as automated feedback have thus been designed and tested to influence human decision making towards sustainable direction without the reduction of freedom.

Recent literature has started addressing the impact of AI more specifically in influencing our behaviour. Studies have been conducted in European and North-American regions which have shown a small yet statistically significant increase in recycling intent (Park and Kim, 2022), a moderate reduction in energy usage (Fang et al., 2023), and willingness to cut down meat consumption when AI provides information about them. Most of these impacts have been explained via increase in the user's knowledge about the issues, creation of an emotional appeal through narratives in the information provided by the AI and the non-biased perception of AI as an information source. However, most of these studies have not been conducted in the developing world and in fact none of them has been, to our knowledge, been conducted in Pakistan.

2.3 Environmental Communication in Pakistan

However, compared with the global literature on environmental communication, scholarship on the topic in Pakistan is still limited. Nevertheless, researchers are now starting to characterize this landscape. Studies, for example, found that religious framings-in particular, the emphasis on the Islamic tradition as representing man as an earthly vicegerent (khalifa)- shape environmental attitudes of people in Pakistan (Masud et al., 2023), and that rural communities disseminate environmental information through the help of community-based networks (Alam & Uddin, 2023). In the context of urban areas, the simultaneous occurrence of high concern for and a lack of engagement with the environment has also been discussed, attributing it to constraints of infrastructure, economics, and the dissociation between individual choices and systemic consequences (Rehman et al., 2022; Tariq & Abbas, 2021).

With Pakistan rapidly expanding internet use - to 54% of the population in 2024 (Pakistan Telecommunication Authority, 2024)- research increasingly focuses on the interactions between digital media and environmental communication. Social media activism-for instance, associated with Pakistan's Billion Tree Tsunami project, and climate activism led by icons such as Malala Yousafzai or indigenous climate activist Sarim Burney- illustrates how digital media can play an effective role in spurring environmental activities. Could AI-enabled tools do similarly and through which mechanism? This question will be central to our investigation.

2.4 Gaps and the Present Study's Contribution

Three major gaps in the literature prompt this inquiry. The dominant type of study in the AI–environment behavioural space have been Quantitative, and as such the subjective pathways through which they exert their influence are not fully understood (Gupta et al. 2023); studies on AI and the environment in Global

South are very limited thereby potentially leading to a danger of over-generalized, Western–biased theories; the role of cultural mediators between the influence of AI on environmental behaviour and human environmental behaviour are not well conceptualised. This study contributes to filling this third gap through the present exploration of people in Pakistan's perceptions, resistance and ambitions regarding the ways that A.I may or may not be influenced on environmental behaviour, in their own words.

3. Methodology

3.1 Research Design

The study employed a qualitative research design, and based on a constructivist-interpretivist epistemological frame (Lincoln & Guba, 1985), because the inquiry aimed to explore how participant s understand the social and ecological meanings that they make of AI interaction in environmental behaviour, rather than seeking to determine pre-ordained responses and impacts. This means of enquiry also lend its purpose to the method of reflexive thematic analysis as conceptualised by Braun and Clarke (2021), because this methodology is flexible and capable of addressing emergent findings, whilst also establishing rigour through reflexivity and transparency.

3.2 Participants and Sampling

The 24 participants were drawn using a combined strategy of purposive sampling and snowball sampling. Participants were eligible to take part in the study if they a) were based in one of four large Pakistani urban centres, including Islamabad, Lahore, Karachi, and Peshawar; b) used AI ChatBots/Virtual Assistant at least once per week; and c) were above 18 years of age. Participants were selected with consideration for gender diversity, age variety, education, and urban origin but were not meant to be statistically representative. See Table 1 for the demographics of participants.

Table 1

Participant Demographic Profile (N = 24)

Code	City	Age	Education	Gender
P01	Islamabad	24	BS Environmental Science	Female
P02	Lahore	31	MBA	Male
P03	Karachi	19	Undergraduate	Female
P04	Peshawar	27	BS Computer Science	Male
P05	Islamabad	42	PhD (Education)	Female
P06	Lahore	22	Undergraduate	Male
P07	Karachi	35	MS Sociology	Female
P08	Peshawar	28	BA (History)	Male
P09	Islamabad	29	MS Climate Change	Female
P10	Lahore	45	Secondary	Male
P11	Karachi	23	BS Mass Comm.	Female
P12	Peshawar	33	MA Economics	Male
P13	Islamabad	21	Undergraduate	Female
P14	Lahore	38	MBBS	Female
P15	Karachi	26	MS Engineering	Male
P16	Peshawar	20	Undergraduate	Female
P17	Islamabad	31	LLB	Male
P18	Lahore	24	BS Agriculture	Female
P19	Karachi	40	MBA	Male
P20	Peshawar	22	Intermediate	Female
P21	Islamabad	37	PhD (Physics)	Male
P22	Lahore	25	MS Public Health	Female

P23	Karachi	29	BS Architecture	Male
P24	Peshawar	34	MA Development Studies	Female

3.3 Data Collection

In-depth, semi-structured Interviews for a data collection were carried out from January to April 2024. A guided interview protocol was constructed based on the existing literature and pilot tested two times for the final data collection (n-2. Not in-included). This structured guideline contained four theme areas; a)general use of AI; b)experiences related to the environment and AI encounters, c)influence over attitude and behaviours; d)critical view on AI limit.

Participants were probed for additional information according to emerged topics during the interview, hence Follow-up-question was prepared within the guide. Due to a number of students scattered geographically and varying their work schedules to be carried out online, there are Nine Interviews that were done in-person at universities premises and community based places. Hence Fifteen Interviews were carried out using video call through Zoom or WhatsApp. Duration of interviews vary from 45 minutes to 80 minutes (average time 62 minutes). Seven interviewers used mostly Urdu Language.

All recorded interviews were fully transcribed verbatim and translated in english by two separate bilingual research assistants whose translated work was checked in order to maintain authenticity of transcription against original interview record.

3.4 Data Analysis

A reflexive thematic analysis followed the six-stage process set out by Braun and Clarke (2021), involving the familiarisation with the data, generating initial codes, searching for themes, reviewing the themes, defining and naming the themes and reporting. The data was analysed inductively at the semantic level and then at a deeper, latent level that considered underlying assumptions and interpretations. Reflexivity was engaged in a reflexivity diary that the lead researcher kept throughout, which captured analytical choices, challenged assumptions and sites of uncertainty. With 8 participants the interpretations were verified by means of member checking, via e-mail correspondence sent as text message attachments summarizing provisional themes, with all the participants agreeing that these were a reasonable interpretation of their experiences, three participants providing small points of clarification that were subsequently integrated into the final structure.

3.5 Ethical Considerations

The approval was obtained from this board before beginning data collection. Participants were given the opportunity to provide written informed consent, and anonymity was ensured using participants' codes and data from transcripts excluding all identifiers. The study was deemed to be low-risk and did not require special considerations such as deception or attention to vulnerability issues, except perhaps concerning the risks associated with privacy on digital platforms as Pakistan navigates its evolving digital privacy regulations.

4. Findings

Six themes emerged from the analysis of the 24 interview transcripts; each theme and supporting quotes are provided below. Urdu-language interviews quoted

are in English translation. Where the translation has unavoidably diluted original intent an additional phrasing is included.

Theme 1: Conversational AI as an Accessible Environmental Educator

This access to information via AI chatbot felt to most people in the sample, "personal more than institutional". Participants were clear about how interactions with AI bots felt fundamentally different from web searching, using books and official governmental information or campaigned materials "There's a dialogue here with an AI. I would never have that directly from a government department … it feels very different". As one postgraduate student in the field of climate change said P09 "When I am researching climate change in relation to my studies".

> *"Before, when I wanted to understand something about carbon emissions or water scarcity in Pakistan specifically — not general global stuff — I would spend an hour going through papers I couldn't always access or government reports that were either too technical or too outdated. With ChatGPT, I could just ask in Urdu, ask again, say I didn't understand, and get a simpler answer. That back-and-forth made it feel like I was actually learning, not just reading."*

This finding was most evident with our novice respondents-participants who had had no previous significant contact with environmental subject matter. P03, a 19-year-old student from Karachi, described the experience of talking to the Google chatbot Gemini as having been instrumental in the way she thought about plastics pollution in coastal communities:

> *"I asked it why the beach near my house looks so dirty even after cleanup campaigns. It explained the currents, the informal settlements, the lack of*

> *municipal bins things nobody had ever explained to me before. I wasn't expecting it to know about Karachi specifically, but it did, mostly."*

This qualifier also seems to predict Theme 3 and Theme 5: although most (if not all) participants reported on the limitations of the AI's geographical specificity and its capacity for generating a culturally authentic account with a rapid turn-round time, higher education participants (P05, P09, P21) displayed a stronger habit of cross-referencing responses with academically grounded texts, whilst lower-educated participants reported a higher degree of prior faith in the accuracy of AI generated information.

Theme 2: Normalisation of Green Behaviours Through Habitual AI Interaction

The second, and in theory the most important, was that it was not single transformative exchanges with AI, but rather multiple instances of AI communication that seem to progressively normalize ecologically friendly behaviors. These are the instances of so-called "accumulative effects" which participants spoke about as small conversational "epiphanies" leading to a gradual transformation of habits over weeks and months. Below, P02, a 31-year-old in the MBA graduate, working for the corporate sector in Lahore explained:

> *"It started when I asked Alexa to add something to my shopping list and she mentioned I think because I had asked before about sustainable shopping that the brand I was looking at had a poor environmental score. I looked it up, changed to another brand. Now it happens almost automatically. I check these things. It became a habit because the reminder kept coming, not because of one big moment."*

This account aligns with the habits literature in describing a process driven by context cues and repetition that leads behaviors to become an automatic part of

life. While the participants did not articulate this process using the language of behavior change science, the behavioral mechanisms they described - cues and associated actions - map well onto what have been characterized as models of habit formation (Wood & Neal 2007; Duhigg 2012). For example, P11, who works in media in Karachi, linked habit-driven AI use to less deliberation:

> *"I don't think about it anymore when I ask Siri to find me a recycling point or ask ChatGPT whether something is biodegradable. It's like asking a friend you just do it. That's probably how behaviour changes, not through big campaigns but through small moments becoming automatic."*

Importantly, this theme did not apply across the board. Where AI was being used by people predominantly as an entertainment tool or in work contexts that did not necessarily link to lifestyle decisions (P06, P10, P19), there was no sense of similar normalisation being afoot. This normalisation cycle of using AI for environmentally adjacent decisions thus seems to be both enabling and enabled by existing interests.

Theme 3: Credibility, Trust, and the Social AI Persona

There were complex and at times, contradictory responses concerning how participants evaluated the authority and credibility of AI output regarding environmental content. None of the participants applied a single approach or simply trusted or mistrusted AI. Rather, there was a complex understanding of different categories of claims made by AI. g.g. "), trust waned significantly.

> *"For factual things like whether a certain chemical is harmful or how much water is wasted in flood irrigation, I trust it. But when it tells me about what NDMA [National Disaster Management Authority] is doing or whether the smog in Lahore is better this year, I check. I've caught it being wrong or outdated a few times." (P14, physician, Lahore)*

Interestingly, the social or relational quality of the AI interaction — its conversational warmth, its apparent patience, and its responsiveness to follow-up questions — was separately cited as a source of perceived trustworthiness that participants recognised as potentially misleading. P21, a physicist and self-described rationalist, articulated this tension with unusual precision:

> *"The thing about these AI tools is that they're convincing not because they're always right but because they sound right. The confidence of the language, the smooth way they explain things — it creates a kind of trust that I have to consciously work against. I use it as a starting point, not a conclusion."*

This observation points to a significant methodological and ethical concern: the communicative competence of social AI may generate inflated credibility perceptions among users who lack the domain knowledge to identify inaccuracies. P03 and P16, both undergraduates without specialised environmental training, expressed substantially higher unconditional trust in AI outputs than the more educated participants, suggesting that educational background moderated critical AI engagement.

Theme 4: Socio-Cultural Mediators of AI Influence

Perhaps most uniquely, one study, a Pakistan based one provided the chance to analyze how culture influenced the AI- environment relation.We found four kinds of Socio-Cultural mediators: house & family,Religious Framings,Gender & Religious Norms , Urdu-EnglishLanguage Divide.

Family & house were most commonly appeared mediators for the relationship of intention of individual towards behavior in relation of AI prompted intention. For example, one of our study had the reports where women were more inclined not to act upon the suggestions from the AI system in respect to the family norms

or decision of elders. One such female undergraduate from Peshawar-based university, P16, tried to implement composting at their household after being inspired by learning it through the system:

> *+"I told my mother about composting — I even showed her the conversation. She said it's fine for 'alag qisam ke log' [different kinds of people] but not for our neighbourhood. What would people say? The AI doesn't know this. It tells you what to do but not how to do it in a Pakistani home."*

Religious framing emerged as both a facilitator and a complicating factor. Several participants noted that when AI responses to environmental questions incorporated Islamic concepts — stewardship of the earth, prohibition of israf (waste), respect for water as a divine gift — they found the information more personally resonant and motivating. P08, in Peshawar, described asking ChatGPT explicitly whether environmental protection was an Islamic duty:

> *"It gave me a very good answer, cited hadith and Quranic verses. I was genuinely moved. I shared it with my friends at the masjid. That conversation did more for my awareness than a hundred government ads. But I wonder, did it get the citations right? That's the part I worry about."*

Gender norms emerged as an independent mediator. Female participants reported that domestic AI usage was often negotiated within family structures, with some describing having to justify their device usage time. Male participants, by contrast, described AI use as largely uncontested within their households. This asymmetry suggests that analyses of AI influence on behaviour must account for the gendered nature of both technology access and behavioural agency in Pakistani households.

The language divide deserves particular attention. The majority of participants who used AI primarily in Urdu reported that the quality of

environmental responses in Urdu was noticeably lower than equivalent English prompts — less contextualised, more generic, and occasionally grammatically awkward. P07, a sociologist in Karachi, framed this as a structural equity issue:

> *"If the AI speaks English better than Urdu, then who is it really educating? The people who already have access to English-language media and academic resources? The poorer, less-educated Pakistani who needs the information most is precisely the person the AI serves least well in Urdu. That's not environmental democratisation — that's a different kind of digital divide."*

Theme 5: Limitations, Frustrations, and Active Resistances

However, not all participant experiences were positive. A majority of the text highlighted dissatisfaction and in some cases, even protest, against AI environmental communications. Of the three distinct types of perceived limitation, the one mentioned most frequently was:

Geographical irrelevance AI recommendation was too culturally skewed, leaning on Western environmental outlooks The recommendations given were shallow, performative or of questionable validity Geographical irrelevance was by far the most frequently cited frustration, being observed in one way or another by 18 of the 24 participants. Essentially, it appears the nature of many recommendations made by AI environmental agents was out of sync with actual Pakistani environmental practice and conditions. As secondary school teacher and largely self-taught resident of Lahore, P10 illustrates:

AI recommendations were based in geographies that do not represent Pakistan in real life! For example, one of the recommendations it made to reduce electricity consumption included increasing the number of people who do cooking together in a single kitchen. Now, most Pakistani houses are split, either

horizontally in apartment complexes or vertically with the household spanning across floors with kitchens present on multiple levels, especially in larger homes. And the number of occupants are typically much more, with as many as 10-12 people living in a home.

That reduces the opportunity of having a single kitchen for the whole family to use.

> *"It told me to use public transport instead of a motorcycle to reduce my carbon footprint. Our public transport here — you know what it is. And my motorcycle, I need it to reach the market, to take my children to school. The AI doesn't know my city. It knows some city in Europe or America. The advice is useless to me."*

Algorithmic bias against Western environmental frame was expressed most vividly by participants with a social science or humanities expertise. P07 and P12 were each able to independently articulate that an AI answer will often centre around individual consumer action – recycling, diet, purchases – rather than anything that might include a structural or political explanation. "There is always a temptation with this technology…" an economist in Peshawar (P12) said, "

> *"Every time I push it toward structural questions — who is responsible for Pakistan's pollution, what the multinationals are doing, what China's investment is causing — it gets vague and balanced. It's very good at telling me to buy reusable bags. It's very bad at talking about power."*

Several participants also noted a performative or ritualistic quality to AI environmental advice that they found difficult to translate into sustained motivation. P19, a business executive in Karachi, described a pattern of engagement followed by disengagement that he attributed to the absence of social accountability:

> *"You feel good after talking to the AI about sustainability. You feel informed, even virtuous. But there's no follow-through built in. Nobody checks if you actually did the thing. In my family or community, there would be social pressure. AI gives you information but no community."*

This observation anticipates findings from social norm literature that emphasise the role of social accountability and peer observation in sustaining behavioural change . The absence of social embeddedness in AI interactions may be a structural feature that limits the tool's capacity to generate durable behavioural shifts beyond initial attitude change.

Theme 6: Aspirations for a Contextually Intelligent Social AI

The last theme abandoned discussion of what social AI was doing/did to consideration of what it could or should be doing differently regarding environmental communication. Perhaps counterintuitively, most participants remained optimistic about social AI in general and provided many well considered and concrete suggestions for improvement, despite their criticisms in Theme 5. The interview segment with participants' optimistic imaginings often featured most participants at their most articulate. The dominant suggestion was for AI to have greater local contextualization, to draw upon Pakistani geography, infrastructure, culture and political economy, and 20 of the 24 participants put it this in way. As this P09 elaborated with a high degree of accuracy;

> *"I want an AI that knows that in Islamabad, I have access to a recycling programme, but in Peshawar, I do not. That knows that the Indus River is different from the Thames. That knows that saying 'call your elected representative' means something different here than in the UK. This isn't impossible — it's a question of what data was used to train it and whose environment that data was drawn from."*

A smaller subset of our participants indicated a desire to see specific applications of AI that leverage and contribute to the body of Islamic environmental scholarship and in particular an understanding of fiqh regarding environment management and Islamic ethical framing in relationship to environmental management along side other types of ecological information [P3]. The expression here points to an aspiration for applications of AI that do not place the burden on the Pakistani user to 'translate' western eco-thought into local epistemological and motivational categories but engage directly with categories and ways of knowing and being that already motivate and are meaningful.

Another subset expressed interest in what they identified, at times, as 'community' or 'neighbourhood' AI which could link an individual's environmental actions and habits to broader community action such as local composting programmes, tree planting networks, waste reduction strategies, etc. P22, from Public Health in Lahore commented, I want my action to matter and to be part of a wider effort, to know that I am part of an existing ecosystem [that my action is part of something bigger] .. It would be the equivalent of this personal health then becomes community health as well which is in.

> *"The best public health interventions work through communities, not individuals. If the AI could connect my choice to compost with a neighbourhood programme that collects organic waste, I would not just feel good about my individual action — I would feel part of something. That's what creates lasting change."*

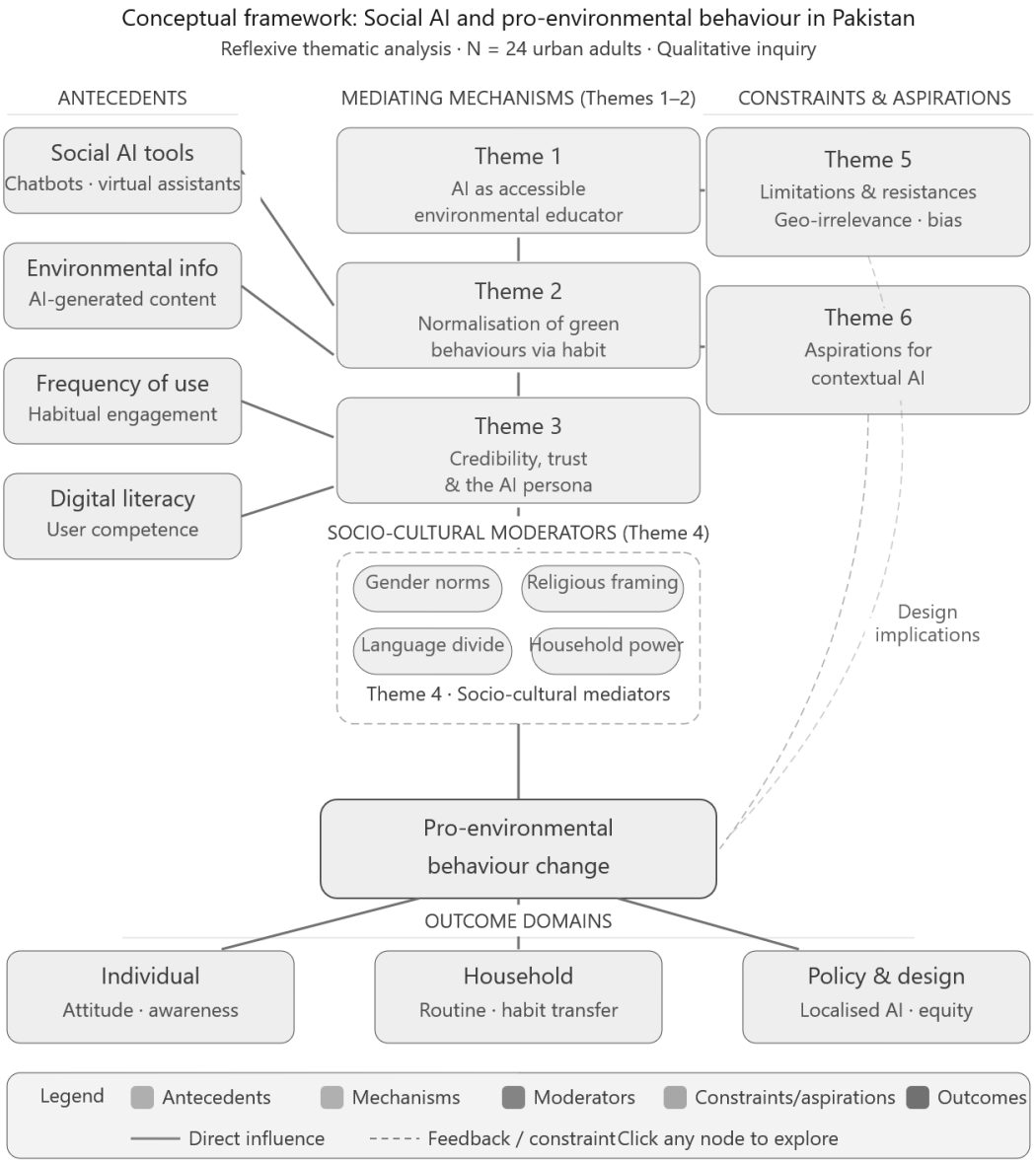

Figure 1: Proposed Framework

5. Discussion

Collectively, the six themes arising from the current study suggest social AI tools hold a marginal, yet constrained, place in the ecology of pro-environmental communication in urban Pakistan. The constructivist framework employed in this research enables a framing of the results not as universal facts of the AI environmental turn, but rather as situated accounts mediated by the social,

infrastructural, and autobiographical particularities of Pakistani urbanites. Several areas of alignment and divergence with existing research deserve further attention. , 2023; Liao & He, 2024).

These accounts are significantly complicated, however, by the fact that the quality and culture specificity of information produced by conversational AI tools are heterogeneously distributed across languages – Urdu users uniformly report worse quality responses than English users. Unlike existing scholarship that mostly examines the AI phenomenon through monolingual English lenses, this paper demonstrates the way this democratising premise can be complicated by linguistic hierarchies embedded within training data. Second, the normalization of green behaviors through AI-assisted routine (Theme 2) makes a useful contribution to the technology-mediated behavior change literatures. Currently, existing theoretical frameworks of this topic tends to focus on singular discrete instances of dramatic intervention -- a documentary that transforms one's belief set, a fact which profoundly shapes one's perspective -- rather than an ongoing process.

Here, however, the author discusses how people change by small degrees through gradual interaction without making a deliberate choice as well as the importance of consistency of the tool, and the accessibility of this kind of habit based changes. These Findings are aligned with studies concerning Habit Formation (Wood & Neal, 2007). Third, the credibility dynamic described in Theme 3 opens up important questions regarding the ethics of AI design. Given the significance of the finding that the participants of study know that interactive fluent text does promote a false sense of authority in AI tools -- something for developers and regulation bodies alike, not the public -- a conversational interface which does nothing but enhance credibility no matter what, may generate a considerable risks for certain kinds of citizens.

Especially for those with limited literacy, an environment with information available does have a risk. Those Findings also match current studies concerning AI hallucinations and they do have effects on user decision-making processes. The fourth thematic axis of the findings (socio-cultural determinants of the behavior change), highlights the unique contribution of this study within the Pakistan-specific research: whether family gender dynamics, Religious framing, and the Language barrier have effects on user relationship towards eco-friendly behavior change using AI. AI devices don't act alone in an isolated space; they interact with pre-existing social structures and dynamics that amplify or diminish the impact.

Next, researchers might analyze the effect of these factors on behavior change via interaction with the AI, instead of solely analyzing individual variables such as an individual's level of knowledge about the environment or perceived competence with computers. Fifth, although not a final but preliminary aspect, my interview data indicate the role of the social media interaction with the AI in environmental behavior changes as my data has some hint of interaction pattern with the media in which AI is used (Theme 5). However, these data need to be interpreted with careful. I see an exciting research avenue towards building better AI to enable environmental behavior changes in local communities and that could be described with the last theme of this study.

6. Conclusion

We aimed to investigate how social AI - that is, chatbots and virtual assistants - could enable and encourage pro-environmental attitudes and behaviours among adults in Pakistani cities. To address this question, we conducted in-depth interviews with 24 participants from four cities in Pakistan and analysed this data using reflexive thematic analysis. We identified six themes, which together

demonstrate a modest but significant influence, limited by structural inequality and cultural specificity-features that are largely overlooked in the existing literature on AI and the environment.

The most effective social AI tools, in the Pakistani urban context that we studied, were perceived as accessible, non-judgmental and patient interlocutors, which gradually began to normalize environment-related discourse in their daily lives among an already somewhat environment-oriented audience. Ineffective social AI was constrained by geographical and cultural insensitivity, language disparity, inflated confidence in authority among low-educated users and a lack of a social account-ability framework to prompt action. These constraints are not a technological inevitability, rather a product of the design, training and market incentives of social AI systems.

This study has implications for multiple groups. For developers of AI, including social AI in environmental applications, we emphasize the need to employ locally-specific, multicultural and multi-lingual training data. For environment communicators and educators, the research suggests that social AI, particularly when paired with local cultural traditions, such as an Islamic ethic for nature, offers a real opportunity to foster engagement with the environment and promote environmental literacy. For public bodies and policy-makers in Pakistan, this study offers a clear warning of equity risks in an AI-driven environmental information landscape in which the information access, knowledge, understanding and participation of women, low-educated populations and Urdu speakers is systematically constrained.

There are several limitations of this study. Our sample, while purposively diversified for various attributes, was confined to adults in urban areas who have access and have adequate literacy skills to interact regularly with social AI tools. Rural Pakistan - an region more acutely vulnerable to climate change and more

vulnerable still, of course, to gender inequalities - is absent from our analysis. Further research needs to build upon this study by also examining social AI in rural and peri-urban contexts, younger adolescents, as well as by employing longitudinal designs that trace changes in environmental beliefs, attitudes, values and behaviors over time, rather than by attempting to reconstruct this development retrospectively.

Combined with digitaltrace data from user activity on social AI and/or observational measures it may also prove possible to infer causality more clearly with mixed methods designs. Ultimately, this research reaffirms the widely held understanding that technology is never socially neutral. As with all technologies, our study highlights that even tools that appear to be neutral and culturally unaware, in reality, reflect assumptions about users, their experiences and the prioritization of specific interests by designers, trainers and product developers. Recognizing and reflecting the assumptions contained within social AI in local contexts across the Global South is, not simply, an interesting research agenda; it is also, in our view, essential for ensuring that tools for environmental engagement in the 21st century promote healthy ecological relationships for all members of humanity, not merely those with whom English-speaking, US-centric engineers interact.

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