# HCI for Climate Change: Imagining Sustainable Futures

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Imagining Sustainable Futures

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As the climate crisis is turning into one of the most critical issues of our time, HCI researchers keep reflecting on the role their work can play in reducing the impact of adverse environmental changes. Suggestions have been made to expand Sustainable HCI (SHCI)'s intervention area to policy design to have a larger impact, consider non-human actors' perspective to incorporate the value of biodiversity, develop multidisciplinary competencies and work across disciplines to understand climate change, and finally make it understandable to citizens and pave the way for their action. This workshop calls to discuss the different angles from which the problem of climate change has been addressed by the CHI community so far. We believe these different angles have several contact points, and the convergence of these different perspectives would help HCI researchers better imagine sustainable futures.

CCS CONCEPTS • **HCI theory, concepts and models** • **Sustainability**

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**Additional Keywords and Phrases:** Climate change, Environmental data, Future scenarios, More-than-human, Policy Design, Social Justice, Sustainability.

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## 1 BACKGROUND

As the climate crisis is turning into one of the most critical issues of our time, HCI researchers keep reflecting on the role their work can play in reducing the impact of adverse environmental changes. In this one-day workshop, we aim to convene the CHI community to discuss how HCI can address issues related to climate change from different angles.

Sustainable HCI (SHCI) has long focused on exploring how digital technologies raising awareness and fostering a more sustainable lifestyle among individuals can help tackle the environmental crisis [8,11]. However, keen to make a difference, recent contributions in the CHI community are questioning and reframing the efficacy of leveraging the behavior of individual consumers to impact the environmental crisis and suggest SHCI a shift of focus. On the one hand, suggestions have been made to restrict the focus, tackling climate change as a priority rather than considering the whole spectrum of environmental issues [13] and exploiting existing and consolidated HCI skill sets to tackle the crisis [4]. On the other hand, scholars advocate for expanding the focus from individual consumers to policymakers and policy design to have an impact at a larger scale [4,20] and considering new perspectives in the discourse on climate change by collaborating with a wider range of stakeholders, including non-human actors [5].

Acknowledging the interconnections among different species challenges the existing anthropocentric and growth-centered perspectives [15]. This view calls for adopting a more-than-human approach to help SHCI researchers understand better the uneven impacts of the changing planet as it affects both human and non-human communities and extend their perspective on climate change risks by incorporating the value of biodiversity, other "non-market" assets and the experiences of communities already experiencing climate change first-hand [22].

Understanding the climate change phenomenon (i.e., its causes, dynamics, and impacts) is the basis for action and implies dialoguing with other disciplines and democratizing data. Since most climate change discourse occurs outside HCI [21], HCI researchers are called to develop multidisciplinary competencies and work across disciplines [14] to understand the phenomenon first and then make it understandable to citizens. As data and information technologies have the power to frame our understanding and responses to climate and sustainability challenges, the work of making data understandable should not come at the expense of understanding the complexity of the phenomena. For example, the interconnections with multiple variables of the three pillars of sustainable development, i.e., economy, sociality, and the environment, are the basis for social and environmental justice. Finally, it is pivotal for HCI to make data not only understandable but also a trigger for individual and collective action, avoiding the current disconcerting and anxiety-generating pictures of climate change in favor of a hope-ful vision [3].

In sum, climate change raises a series of challenges that the HCI community has been addressing from multiple angles. In our view, these different angles have several points of contact and would benefit from finding synergies. To cover a broad spectrum of works while focusing on climate change, we have chosen four main themes that can work as action spaces for HCI in climate change mitigation and discussion spaces during our workshop.

### 1.1 HCI's original skillset: making data understandable, usable, and actionable

This theme aims to improve the accessibility, understandability, and salience of climate change models and data to expand whom we consider environmental data users [21] and envision narratives that go beyond the disconcerting and anxiety-generating pictures of the current climate change discourse to become a starting point for action [3]. A strand of HCI work has called attention to how data and information technologies frame our understanding of climate and sustainability challenges, in turn delimiting the sorts of responses we might imagine. Such work has sought to demonstrate how environmental data "have a powerful impact on how we come into relationship with nature, and how these relationships evolve and are sustained over time" [21]. Research in this area has focused on making sense of climate data, grounding it in more relatable experiences and understandable narrative forms. For example, by combining citizens' lived experiences with objective data on air quality [16], looking at the role of grassroots data collection in unsetting official narratives of crisis and disaster [14], and engaging with art [12] or with interactive and transmedia storytelling [9]. Building upon the Data Humanism manifesto[1] by Giorgia Lupi, which proposes an analysis of stories as small data (i.e., imperfect, subjective, inspiring, serendipitous), we can get glimpses of how to translate the complexity of the world, its open possibilities, people, humans. Similarly, building upon the work of De la Bellacasa [2] that articulates scientific knowledge as politics, we propose to articulate further the potential of data in "making things matter" and thus become actionable for multiple actors.

### 1.2 Anticipatory governance: informed future scenarios for policy makers

In recent years, HCI has started reflecting on the intersection of public policy and technology [17], and several opportunities have been identified to engage the HCI research community specifically with climate change policies [25]. Typically, environmental researchers and policymakers rely on computer simulations based on large sets of environmental and socioeconomic data to run integrated assessment models and climate change scenarios to identify possible pathways and tradeoffs of strategic planning [1]. Yet, the potential of integrated assessment models is limited because they are complex, and often, the information they provide is not salient to local users or communities [19]. In this regard, Spaa et al. [24] propose to add the practice of imagining futures as a core component of policymakers' work. For instance, climate change scenarios created through modeling techniques could be enriched with insights coming from speculative reflections on alternative futures. Speculative methods and practices, such as the future cone and design fiction [9], have been recognized for bringing several benefits to HCI, such as encouraging participatory discourse about sustainability and the future, improving awareness, and questioning values and ethics behind current practices, investigating topics that carry uncertainty, such as future scenarios and other-than-human perspectives [23]. In our view, there is a need for expanding this research domain to explore better the potential of envisioning methods for policymakers to make decisions for the common good.

### 1.3 Embrace plurality of point of views: more-than-human actors at play

Since human's intimate entanglement with digital technologies and more-than-human realities have begun to challenge the foundations of current HCI research and practice, Frauenberger proposes post-humanism and relational ontologies as the basis of HCI's new fourth wave, called Entanglement HCI [10]. Building upon Entanglement HCI, this theme focuses on the shift from human to more-than-human and environment-centric research theories, methods, and practices. Extending the boundaries of HCI research to consider the interests of a variety of actors and stakeholders is crucial not only to have a wider impact but also to enlarge our perspective on climate change and the concept of

[1] http://giorgialupi.com/data-humanism-my-manifesto-for-a-new-data-wold

vulnerability, which can pertain to people as well as other living beings and natural habitats (e.g., glaciers, rivers) [6]. As HCI aims to secure a lasting impact for technology-based interventions addressing environmental and social inequities, feminist theories, post-phenomenology, and posthumanism come into play. Researchers within feminist technoscience have embraced 'diffraction' as an important concept to account for difference rather than sameness [7]. Haraway explains that "to do science through a diffracted lens is to grasp different directions and intentions within a phenomenon and at the same time have the openness to be touched by the difference that is provided"[7]. These developments in HCI research outline an agenda for future work that embraces our entangled relationships with more than humans, such as technologies, environments, and other living species.

### 1.4 Attending to complex and intertwined variables for public engagement

Work in this vein seeks to support people in understanding the interactions of climate change variables across sectors (e.g., environment, economy, social life). For instance, climate change and socioeconomic development are deeply intertwined: on the one hand, social and economic activities are the main drivers of climate change, and on the other hand, climate change impacts these activities heavily [18]. Although the early work of Sustainable HCI has been critiqued recently for its focus on individual behavior over systemic change [4,18], this research continues to play an important role in communicating the scale of climate change both at the global and local levels. Sustainable HCI researchers should continue investigating how we design technological tools to support decision-making at the individual level and use its long-developed educational skills to teach individuals how to use resources more efficiently in a context with resource constraints. For example, it can help people understand how to lower their energy and carbon impact by disambiguating the impact of individual lifestyle and consumer choices on a global level [4] and play a role in understanding the ways that different communities experience climate change at a local level and what tools they need to live healthy, safe, and just lives. We believe this topic is worth investigating as it complements top-down policy initiatives with the opportunity for people to make informed choices.

In sum, we believe these themes can capture and stimulate dialogue among the broad range of perspectives on HCI and climate change that we find in our community. With this workshop, we would like to offer a gathering where HCI researchers, designers, and activists working on environmental topics can meet to discuss their research and possibly find points of contact between their different perspectives on the role technology can play in ensuring sustainable futures. Possible topics for submissions may include (but are not limited to):

- Communicating science
- Data physicalization, visualization, sonification
- Community engagement and activism
- Policymaking
- Envisioning future scenarios
- Eco-social relations and social justice
- System thinking/interconnection of economic, social, and environmental dimensions
- Interdisciplinarity and new competencies for HCI researchers
- Post-human, more-than-human, diffractive and entangled views, theories, and practices

## 2 ORGANIZERS

**Eleonora Mencarini** (main contact) is a researcher in Human-Computer Interaction at Fondazione Bruno Kessler (Italy). Her main research interests are co-design, embodied interaction, and interaction design in natural environments. Currently, she leads a WP in the EU project NEVERMORE about adaptation and mitigation strategies against climate change. She led the organization of the 'NatureHCI' workshop at CHItaly'21 and the 'New Trends in Sports and HCI' workshop at MobileHCI'22.

**Christina Bremer** is a final-year Computer Science PhD student at Lancaster University (UK). With a background in cognitive science and HCI, and a keen interest in sustainability, her research focuses on factors that shape the energy-saving potential of behavior change and energy efficiency technologies in buildings. Alongside her research, Christina works as a UX designer for a start-up that specializes in energy forecasting.

**Chiara Leonardi** is a researcher in Human-Computer Interaction at Fondazione Bruno Kessler (Italy). Her work is at the intersection of Social Sciences and Computing. Drawing from qualitative approaches and applying inclusive and participative methods, her goal is to understand users' needs, values, and practices and envision novel digital solutions that address societal and environmental issues.

**Jen Liu** is a PhD student in Information Science at Cornell University (USA). Her research investigates the ecological, social, and political implications of computing technologies and infrastructures. Jen has worked on topics including land politics in digital agriculture and knowledge production in environmental sensing. Her current work is on the impact of climate change on networked infrastructures in the American South.

**Valentina Nisi** is a tenured Associate Professor at IST, University of Lisbon (Portugal), Adjunct Faculty at the HCI Institute Carnegie Mellon University (USA) and founding researcher at the Interactive Technologies Institute (ITI LARSyS). Her research encompasses Interactive Digital Storytelling, Gaming, and HCI, bringing awareness and care to pressing social and environmental issues. Spanning from Fine Arts, to Design and HCI, Valentina's background contributes to an interdisciplinary view on sustainability and climate change issues combining a Research-through-Design approach with post-humanistic concerns.

**Nuno Jardim Nunes** is a professor at Tecnico U. Lisbon (Portugal), where he leads the Interactive Technologies Institute (ITI LARsyS). He is also the Director of the Carnegie Mellon International partnership and adjunct faculty at the HCII at CMU. Nuno's research interests lie in the application of models to software, system, and service design for the domains of environmental sustainability and participatory culture. Nuno is a strong advocate of digital as a scale technology for sustainability, and he coordinates one of the New European Bauhaus lighthouse projects: the Bauhaus of the Seas.

**Robert Soden** is an Assistant Professor in Computer Science and the School of the Environment at the University of Toronto (Canada), where he co-leads the Toronto Climate Observatory. Robert uses qualitative and design research methods to evaluate and improve the information systems that we use to understand and respond to environmental issues, in particular disasters and climate change.

## 3 WEBSITE

Useful information to submit and participate in the workshop, as well as the chairs' contacts, will be published on the workshop website at the following link: TBD.

## 4 PRE-WORKSHOP PLANS

We plan to advertise the workshop on all the major international HCI mailing lists (e.g., CHI Announcements, BSC-HCI Digest, EUSSET) and social media channels (e.g., ACM SIGCHI and EUSSET groups on Facebook). Furthermore, the organizers will leverage their personal networks and different affiliations to advertise the workshop to local and targeted groups. Potential participants will be invited to submit a research, reflection, pictorial, provocation, or design fiction paper (min 2 - max 6-page long) using the ACM template format via Easy Chair. The workshop organizers will assess the submissions based on their potential to spark an interesting discussion. Perspective diversity and inclusion of underrepresented groups will be encouraged through the paper selection process, i.e., if papers will be judged equal in terms of ability to generate a discussion, priority will be given to those bringing diverse perspectives to the workshop. Moreover, in the case of papers with multiple authors, we will encourage the authors belonging to underrepresented groups within the HCI community to present them.

## 5 WORKSHOP FORMAT: HYBRID

The workshop will be organized as a one-day hybrid event. In our opinion, one day gives participants enough time to listen to each other's contributions, discuss the topics, and network. The hybrid mode has been chosen to address sustainability and inclusion concerns, which lie at the heart of the workshop. By ensuring both the in-person and virtual modalities, we can offer participation independent of financial and environmental travel costs.

For online participants, we will organize a virtual meeting using a videoconferencing app that allows the creation of separate workspaces or "rooms" such as Zoom, Microsoft Teams, or other similar platforms. For participants attending in person, we will meet them in a room at the CHI conference venue. To put the online and on-site participants in contact, we intend to equip the on-site room with a dedicated laptop, monitor, webcam, microphone, and speakers. These devices will be used in the plenary sessions planned at the beginning and end of the workshop. Then, during the group activities, we will provide access to shared collaborative platforms such as Miro or Google Jam board, which participants can access with their laptops.

Workshop organizers will also be participating in both virtual and on-site contexts. We will designate at least two workshop organizers to coordinate the virtual groups and two workshop organizers for the on-site groups. Workshop organizers will oversee technical and logistic concerns, facilitate the discussions, and keep the timing. To coordinate throughout the workshop, we will set up a backend communication channel for online and on-site workshop organizers. Possibly, we will designate another organizer or a student volunteer onsite to take notes, photos, videos, and recordings of workshop activities. We will ask for participants' consent before starting any documentation.

By organizing the workshop in a hybrid format, we aim to include all the people who might be interested in the topic and willing to spark discussion despite travel costs and the pandemic's limitations. Nevertheless, we know that virtual participation might be hampered by different time zones and unstable internet connections. Therefore, we deem it necessary to enable participants' asynchronous engagement. We will use digital support for remote interaction and develop the workshop activities before and after the actual workshop day:

- Upon acceptance, each participant will be asked to produce a 2-minute-long video presentation that will be shared with all the other participants through a digital repository. By making participants aware of each other's work and topics, we aim to foster the cross-pollination of ideas before the workshop and a fruitful and enriching discussion during the workshop.
- A Miro board (www.miro.com) or a Google Jam board will be created and shared before the workshop so that participants can present themselves and leave notes and comments next to the other submission titles. Furthermore, pictures of the material produced by the on-site groups will be uploaded, and the board will remain accessible also after the workshop conclusion for the CHI conference duration and work like an interactive poster where participants can leave comments asynchronously (post-workshop activity).

## 6 WORKSHOP STRUCTURE

We expect to host between 15 and 20 participants. The overall workshop duration will be 6 hours, with a break every hour to allow participants to take a pause, especially those attending remotely, from sitting at the desk and watching the screen. We plan to structure the workshop as described below (for a summary, see Table 1).

Table1. Workshop schedule

| | | |
|---|---|---|
| 09:00 – 09:15 | 15 min. | Welcome greetings, workshop introduction |
| 09:15 – 10:15 | 60 min. | Brief submission presentations (12 presentations x 5 minutes each) |
| 10:15 – 10:30 | 15 min. | Break and groups set up |
| 10:30 – 11:30 | 60 min. | Group work |
| 11:30 – 11:45 | 15 min. | Break |
| 11:45 – 12:30 | 45 min | Plenary session: discussion and feedback on group work |
| 12:30 – 14:00 | 90 min. | Lunch |
| 14:00 – 14:45 | 45 min. | Keynote speech + Q&A session |
| 14:45 – 15:00 | 15 min | Final reflections, wrap up, and future plans |

- Welcome greetings and workshop presentation (15 minutes). An informal chat will take place while waiting for all the participants to arrive/connect. Then, the organizers will introduce themselves and the workshop's purpose and activities.
- Brief submission presentations (60 minutes). After the welcome greetings, participants will have 5 minutes to present their submissions. Since papers and videos will be shared before the workshop, the focus of this session will be for participants to express the commonalities they have found in each other's work, find common challenges and topics to discuss, and establish connections. This activity will facilitate the formation of working groups during the next workshop phase.
- BREAK (15 minutes)
- Groupwork (60 minutes). Participants will be divided into small groups of 4-5 people and will work on a case study they chose from a list offered by the workshop organizers based on the submissions' topics and address it from their perspective. By doing so, we aim to foster exchange and mutual learning among the different angles adopted by the CHI community to look at climate change issues.
- BREAK (15 minutes)
- Discussion presentation and feedback (45 min). The group activity will conclude with the presentation of the results for each group, followed by a short plenary discussion.

- LUNCH (90 minutes)
- Keynote speech (45 min). A keynote speaker will be invited to increase the workshop's attractiveness and spark a further discussion on a cutting-edge perspective on climate change issues. The speaker will be selected according to the participants' research topics and interests.
- Wrap up and future plans (15 minutes). The workshop organizers will wrap up the workshop by highlighting its results and presenting participants with a few options for the future to continue nurturing the network.

## 7 ACCESSIBILITY

To organize the workshop as accessible as possible, we will collect suggestions from the participants on what they think we could do to facilitate their full participation either online or onsite through a short online questionnaire before the workshop.

## 8 POST-WORKSHOP PLANS

After the workshop, we plan to i) submit an article to ACM Interactions reporting the insights that emerged during the workshop; ii) organize a special issue in an HCI journal, such as TOCHI or the ACM Journal on Computing and Sustainable Societies, to which workshop attendants will be invited to submit; iii) include participants and organizers in a mailing list/newsletter on the topic of HCI and Climate Change where they can discuss new ideas.

## 9 CALL FOR PARTICIPATION

The climate change topic raises various challenges that the HCI community has been addressing from multiple angles. In our view, these different angles have several points of contact and would benefit from finding synergies, and with this workshop, we aim to convene the CHI community to discuss how HCI can leverage its traditional skill sets and multidisciplinary influences to address climate change issues. It will have a one-day hybrid format. Participants are invited to send a short paper (min. 2 - max. 6 pages) in the form of a research, reflection, pictorial, provocation, or design fiction using the ACM SIGCHI template via Easy Chair. Submissions will be assessed by the workshop organizers based on their potential to spark interesting discussions. Upon acceptance, participants will be asked to produce a 2-minute-long video presentation to allow participants to start reflecting upon each other's submissions, find connections, and thus create a close-knit workgroup before the workshop. At least one author of each accepted paper must register for the workshop and at least one day of the conference and attend the workshop. Further information can be found on the workshop website: (TBD). Possible submission topics may include (but are not limited to):

- Communicating science
- Data physicalization, visualization, sonification
- Community engagement and activism
- Policymaking
- Envisioning future scenarios
- Eco-social relations and social justice
- System thinking/interconnection of economic, social, and environmental dimensions
- Interdisciplinarity and new competencies for HCI researchers
- Post-human, more-than-human, diffractive and entangled views, theories, and practices

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