FloraWear: Crafting Living Wearables with Sustainable Materials

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Figure 1: Model wearing FloraWear with sustainable materials

Abstract

FloraWear is a wearable living interface where people can experience close relationships with plants by caring for and wearing them. While plants can have positive effects on both mental and physical well-being, we are increasingly losing our connection to plants due to industrialization and urbanization. To build a stronger relationship with plants, we present FloraWear–a DIY, wearable living interface that facilitates an intimate connection with plants. We discuss how the design of this living interface evolved through an iterative process based on feedback from users. By interacting with FloraWear, people can practice cohabitation with plants and experience becoming a more-than-human assemblage.

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CCS Concepts

• **Social and professional topics** → **Sustainability**.

Keywords

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1 Introduction

Urbanization is a major driver of biodiversity loss [24] and has accelerated the separation between humans and nature [33]. According to the United Nations' World Population Prospects, urbanization is projected to double by 2050, with almost two-thirds of the population living in urban areas [36]. Urbanization can undermine the benefits of living with nature, such as rapid recovery [34], productivity [23], stress reduction [22, 35, 37], and mindfulness [16, 38].

To overcome these challenges, living interfaces have been developed to maintain close relationships with plants and nurture an ethos of care for nature. We designed a wearable living interface called FloraWear to address this growing separation by fostering interactions between humans and plants [27]. This wearable interface was computationally designed and fabricated in order to support plant life and build empathy for non-humans. It was designed to inspire an ethics of care for non-humans. By wearing and caring for these living interfaces, users can regain the physical and emotional benefits of living closely with nature despite their busy urban lifestyles. In prior studies of FloraWear, participants developed emotional connections to plants and experienced mindfulness [27]. This experience influenced their lifestyle and that of their family and friends. However, the material composition of the original interface—thermoplastic polyurethane (TPU) filament—may undermine the goal of the project, making the wearable look and feel too artificial, thus distancing users from nature. To address these shortcomings, we conducted a design probe and then redesigned FloraWear. Based on this research, we identify issues with and present design and material considerations for living interfaces. We find that employing bio-friendly materials in the design of human-plant interfaces can contribute to sustainability in HCI.

This work aims to build empathy for nature through the design of living interfaces. We scope our investigation based on expert interviews, experiments with biopolymers and biodegradable materials for growing media, and digitally designed and fabricated bioinspired forms. Then, we discuss lessons and limitations.

2 Background

The ongoing ecological and climate crises threaten the diversity of life [10] and endanger human health and well-being [1, 2]. In response to these crises, there is growing concern for sustainability and a more-than-human ethos in the computing community. HCI researchers are exploring how decentering humans and computing and instead recentering on the body and vibrant matter can foster a paradigm of care for nature in which non-humans are partners. Within HCI, a new field—*Human-Plant Interaction*—is emerging that studies the entanglement of technology and nature.

2.1 Sustainable HCI

Sustainable Human-Computer Interaction (SHCI) has been mapped and discussed [4, 8, 20]. Blevis identified two key principles for Sustainable Interaction Design (SID): “linking invention & disposal” and “promoting renewal & reuse” [4]. Linking invention and disposal requires considering how new objects will displace or obsolete existing objects. Promoting renewal and reuse emphasizes using materials that support recycling or re-manufacturing. In an effort to promote renewal and reuse, designers have been experimenting with sustainable and biodegradable materials as an alternative solution to finite natural resources and environmental crises [7, 17]. Designer Klarenbeek created a mushroom chair with a bioplastic shell and printed powdered straw [19]. While materials in fashion are often more consumption-focused, designers are identifying sustainable approaches to fashion design [28]. Fletcher argues that material diversity in textiles—which employ limited types of fibers—is essential for sustainable fashion design [11]. Material diversity is analogous to biodiversity—an essential characteristic of sustainability within ecosystems. Fashion designer Campos kitted fabric as a substrate for growing plants on a wearable garment [5]. Architects use sustainable substrates for building structures. Scelsa et al. created a ceramic column for plant habitat [31] and Scott et al. developed mycelium and yarn hybrid biofabrication in the built environment [32]. This work investigates new forms of FloraWear through the lens of sustainability and biodiversity, conducting a material experiment of biocompatible substrates. Over the last decade, the goals of sustainable HCI have evolved [15]. One of the major shifts is repositioning materiality in ways that decenter humans and computing [29]. For example, Bell et al. developed a bio-digital calendar that engages with temporalities of a nonhuman organism [3]. While the earlier FloraWear prototype used TPU filament due to functional benefits for humans and computing, this work shifts focus to materials and design more suitable for plant well-being.

2.2 Embodiment

Embodiment in HCI can help build empathy and nurture an ethos of care. Phenomenologist Merleau-Ponty emphasizes the body in the central position as “a nexus of living meanings” [25]. Merleau-Ponty claims the meaning is “caught up in the context of my body” [26], which conveys meaning is not an abstract perception in an individual's mind but is already placed in the physical world. When an individual moves in the physical world, meaning can be found in these actions and interactions. As Merleau-Ponty claims, the body is tied to the world, unlike Cartesian dualism, which separates mind and body. Embodied interaction can provide unique qualities of physical and emotional transitions for wearers as it shifts their role from viewer to performer [18]. In this transition, as HCI theorist Dourish notes, “Action both produces and draws upon meaning; meaning both gives rise to and arises from action”; individuals can find meaningful experience by engaging in embodied experiences [9]. FloraWear is a living wearable interface that provides close embodied experiences and those embodied interactions and connections can intimately influence wearers' emotions. Wearing and caring for plants can provide a unique and meaningful relationship between wearers and plants since body and mind, motion and emotion, and action and meaning are tightly interconnected [9, 25]. Through mutual care, the wearer and the worn—the human and the vegetal—sustain each other.

2.3 Human-Plant Interaction

Chang et al. surveyed prior HCI work on Human-Plant Interaction (HPI) [6]. They developed an HPI System Architecture, which describes varied ways that HPI prototypes integrate the physical world, technological systems, and plants. Indirect integration entails mediating interactions with plant species without a direct interface component to plants. FloraWear is a form of indirect integration where HPIs are not directly mediated through computing technology. Rather, computing technologies facilitate the design and manufacture of the wearable substrate. Proxy integration involves evoking natural responses in plants through the manipulation of environmental factors. Embedded direct integration employs sensors within plant membranes to assess inherent biological data. An example of embedded direct integration is *pheB* [30], a novel

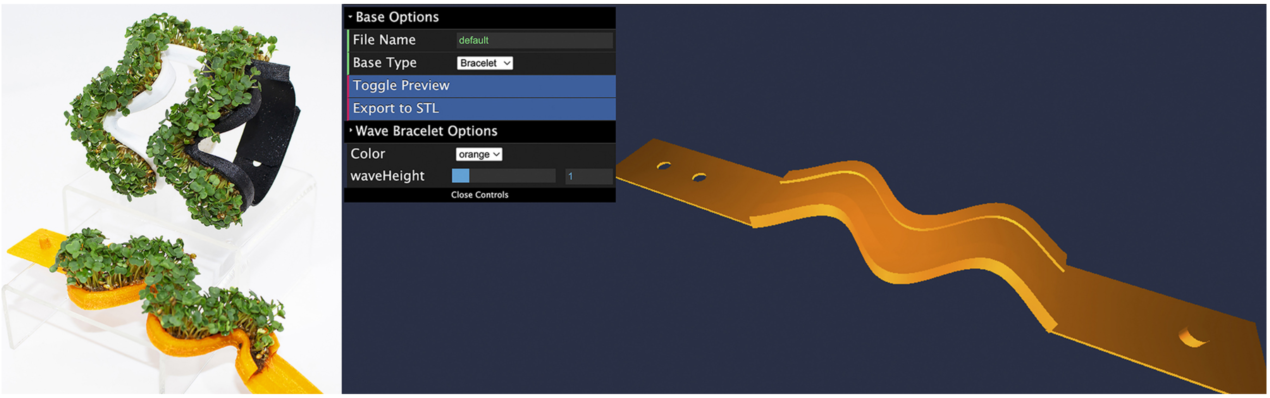

Figure 2: Initial FloraWear design process

biofeedback methodology to foster human connections with nature by embodying plants' internal states through the movement of a soft robotic surface. Augmented direct integration uses micro-scale technologies (e.g., nanotechnology) to enhance the interface between plants and humans. Central to the HPI System Architecture is how input and output to plant systems are coupled with human and environmental interactions. This perspective contrasts with Loh et al., who argue that HCI researchers should "fundamentally reconceptualize plants from utilitarian objects to living co-inhabitants" [21]. Hansen and Rolighed explored non-utilitarian forms of HPI and identified three different sensibilities that arise in HPI transforming human relationships with plants: hermeneutic, existential, and social-cultural [14]. Hermeneutic sensibility relates to how humans make sense of an interactive system. Existential sensibility involves "[acknowledging] plants as active living beings and [placing] ourselves in a wider ontological entanglement." Social-cultural sensibility considers interpersonal relationships between humans and plants. FloraWear inspired human-plant partnerships where reciprocal relationships between human and plant influenced behaviors [27]. These partnerships emerged due to intimate physical proximity between humans and plants as they shared experiences interacting with the world.

3 Methodology

To identify design challenges and opportunities for living interfaces, we designed prototypes, conducted expert interviews, experimented with biomaterials, and redesigned our prototypes in an iterative process. After designing a prototype, we invited six designers to try FloraWear and interviewed them about their interactions with the prototype. The designers followed FloraWear's published instructions [27] to model, fabricate, and plant their own wearable interfaces, using the project's website (http://florawear.netlify.app) to model their design variants. So that the designers could experience and critique fully grown living interfaces, we gave them prefabricated, pre-grown interfaces for a 30-minute trial. After wearing and interacting with living interfaces for 30 minutes, the designers gave feedback during 30-minute semi-structured interviews (Fig. 3). Based on their feedback, we experimented with the use of biopolymers for wearable planting media and then designed another iteration of living interfaces.

3.1 Initial Prototype

The first version of FloraWear [27] was an interface composed of a flexible substrate, a layer of growing media, and a layer of plants. This version was a do-it-yourself (DIY) project that could be designed, fabricated, and grown by users. The substrate could be designed through an online platform (florawear.netlify.app) and 3D printed on a low-cost Fused Deposition Modeling printer using TPU filament. Users would then insert a coir mat as a growing medium into the substrate and plant seeds on the mat (Fig. 2). Then they would wear and care for their interfaces, nurturing their wearable plants for up to thirty days.

3.2 Interviews

To evaluate the initial prototype of FloraWear, we conducted interviews with design experts. We recruited six designers by email and word of mouth. Their disciplines included fashion design, digital design, architecture, and landscape architecture. Designers were aged from thirty-one to thirty-nine (with a mean age of 35.5) and had between eight and fifteen years of experience in their fields (with a

Figure 3: Experts interacting with FloraWear

* M: Male, F: Female

No.	Age(Gender)	Field	Yrs of Experience	Accessories
E1	38 (F)	Digital Design	8	Often
E2	31 (F)	Fashion Design	10	Rarely
E3	34 (F)	Fashion Design	8	Often
E4	35 (M)	Digital Design	10	Everyday
E5	36 (F)	Architecture	15	Often
E6	39 (M)	Landscape Architecture	12	Sometimes

Figure 4: Demographic information of interviewed experts

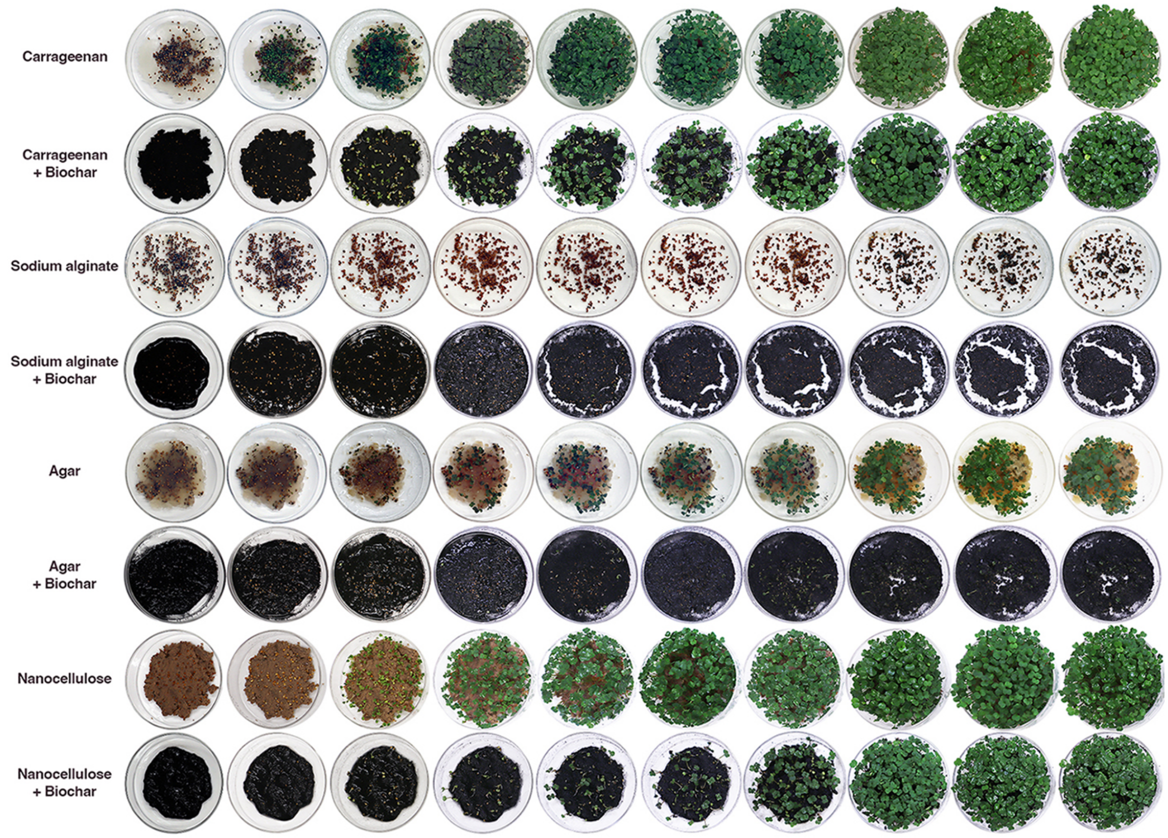

Figure 5: Material experiment with biopolymers

mean of 10.5) (Fig. 4). The interviews were recorded, transcribed, and coded by the first and second authors. During the interviews, we asked these experts about potential target audiences, their design preferences, and their advice on materials for FloraWear to improve the first version of the interface. Proposed target audiences included children for education, elderly people for emotional support, and even non-humans. The general audience range included those who enjoy gardening, the outdoors, or nature. In contrast to the other human-centered proposals, participant E5 suggested companion species as a potential audience. There was diverse feedback regarding design and materials. Some of the experts appreciated the lightweight, flexible materials and the DIY approach to fabrication with FDM 3D printing using TPU filament. Some, however, found that the synthetic material and form distanced wearers from nature. For these designers, the synthetic style and materials of the wearable were in too stark contrast to the plants conceptually, experientially, and formally. They suggested using natural, biocompatible materials that would help sustain plants while enhancing the aesthetics of the design. Material suggestions included ceramics, mycelium, wood, and biopolymers. The designers also proposed mesh structures, transparent materials, and hydroponics as ways to integrate plants and roots more integrally into the design. Participant E6 suggested using natural polymers for substrates that would hold water more effectively.

3.3 Material Experiment

Expert interview responses highlighted a key design need for bio-friendly materials to sustain plants' health and avoid distancing wearers from nature. To develop bio-friendly materials for the substrates, diverse biopolymers were tested in the lab (Fig. 5). We tried two different versions with and without biochar to differentiate nutrients. We selected accessible biopolymers such as carrageenan, sodium alginate, and agar that can easily be found in the market. Carrageenan comes from red seaweed, and sodium alginate is from kelp or sargassum of brown algae. Agar is derived from red algae. All three are natural ingredients and can be mixed with food as thickening agents. We combined biopolymer powders and water at a ratio of 1 to 20 to make a gel. Then we mixed 15g of the mixed biopolymers, 1g of arugula seeds, and 2g of biochar when needed. When we worked with agar, the water needed to be warm, so we microwaved the water for 1 minute. We also used nanocellulose manufactured from sugarcane bagasse fibers as a sustainable way to reuse agricultural waste. During the experiment in the lab environment, we regularly watered all test samples, and all of the samples were fully exposed to UV lights. We observed the daily growth of plants and archived that progress with photos every day. Fig. 6 presents the progressive plant growth on necklaces over the course of ten days. Carrageenan was a healthy growing medium for plants. Its color was relatively transparent so it was aesthetically

Figure 6: Ceramic FloraWear with biopolymers from day 1 to day 10

integrated into the FloraWear interface. Sodium alginate and agar both dried quickly and thus proved unsuitable as media for living interfaces. While nanocellulose supported healthy plant growth and could be a promising medium for living interfaces, it is expensive as it is not yet produced at an industrial scale. Including biochar as an additive did not significantly improve seed vigor during this trial.

3.4 Design Development

In the original design of FloraWear, participants modeled their wearable interfaces in an online application (http://florawear.netlify.app) and downloaded them for 3D printing. Given the do-it-yourself approach, FDM was used since it is the most ubiquitous, accessible 3D printing technology. FloraWear was printed with TPU filament so that the wearables would be flexible and durable. The synthetic look and feel of the TPU wearables, however, may conflict with the project's goals of empathy and care for nature. Based on design suggestions from the interviewed experts, we developed more organic designs inspired by nature and printed them in ceramics. To fabricate these delicate organic designs, we used a FormLab stereolithography (SLA) 3D printer with ceramic resin. According to the material description from Formlab [12], the ceramic resin consists of a silica-filled photopolymer. After firing at a certain temperature, the photopolymer materials were sintered to form a ceramic element. Since Formlab's original ceramic resin was an experimental material, the prints were at risk of cracking, slumping, dunting, shrinkage, and bubble formation during firing. Successfully firing these 3D printed ceramics requires ramp up, burnout, ramp up, sintering, and cool down phases accurately in the kiln [12]. After multiple design iterations to account for shrinkage and to experiment with wall thicknesses and firing times, we finalized designs for necklaces and rings (Fig. 7). For the final design, we used carrageenan gel as a growing medium for FloraWear for nutrition, cost-effectiveness, appealing color, and easy navigation (Fig. 6). Clear carrageenan gel without biochar was integrated into the ceramic substrate, highlighting the organic form of the substrate and providing growing media for plants. Due to plants' heliocentric growth, only the upper half of the substrate was filled with growing media and seeds. For the sake of ergonomics, the back of the pendants was smooth so that they would lay flat against the chest, and thus plants would not directly touch the wearer's body (Fig. 1).

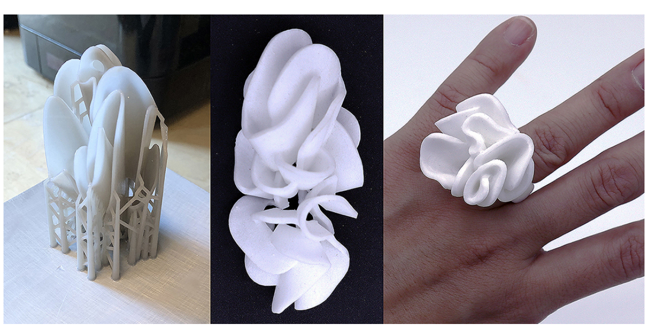

Figure 7: Finalized designs of necklace and ring

4 Discussion & Conclusions

We identified material and design challenges for the development of living interfaces. This work adds to our limited understanding of how to design biocompatible textiles [13], specifically focusing on material substrates that will benefit both plants and humans. Through design expert interviews, material experiments, and posthumanist perspectives, we designed new forms of FloraWear that highlight key characteristics of living interfaces. Living interfaces should be fabricated from biocompatible materials that retain water while supporting seed vigor. We noted contrasting perspectives in our interviews between functional benefits of 3D printing and experiential drawbacks of inorganic substrates. Through a material experiment, we found that biopolymers including carrageenan and nanocellulose hold water effectively and support seed vigor from the daily experiment.

We used a computational design approach to algorithmically generate bioinspired forms for wearables. The petal-like ruffles of the organic forms created cellular cavities that could effectively hold biopolymer planting media and keep moisture for a longer period of time. We used ceramic SLA 3D printing to fabricate these complex organic forms in an aesthetic, sustainable, and water-proof material. Despite the promise of this approach, we identified limitations including material and fabrication costs. Nanocellulose was relatively expensive for a DIY approach in spite of its promise as a planting medium. While SLA 3D printing can produce high-resolution ceramic prints, this technology is more expensive than FDM and it can require time-intensive post-production. In the future, we plan to develop heliocentric form-finding algorithms to create better-growing conditions for seedlings. We also plan to research and adapt other promising biopolymers. Our users found that while wearing and caring for FloraWear, they refigured their relationship with nature and began to think of themselves as being part of an interconnected ecosystem. FloraWear can transform the concept of nature in HCI from a hierarchical relationship to a mutual companionship.

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References

[1] Kamran Abbasi, Parveen Ali, Virginia Barbour, Thomas Benfield, Kirsten Bibbins-Domingo, Stephen Hancocks, Richard Horton, Laurie Laybourn-Langton, Robert Mash, Peush Sahni, Wadeia Mohammad Sharief, Paul Yonga, and Chris Zielinski. [n. d.]. Time to treat the climate and nature crisis as one indivisible global health emergency. 33, 1 ([n. d.]), 37. https://doi.org/10.1038/s41533-023-00358-3

[2] Lukoye Atwoli, Abdullah H Baqui, Thomas Benfield, Raffaella Bosurgi, Fiona Godlee, Stephen Hancocks, Richard Horton, Laurie Laybourn-Langton, Carlos Augusto Monteiro, Ian Norman, Kirsten Patrick, Nigel Praities, Marcel G M Olde Rikkert, Eric J Rubin, Peush Sahni, Richard Smith, Nicholas J Talley, Sue Turale, and Damián Vázquez. 2021. Call for emergency action to limit global temperature increases, restore biodiversity, and protect health. *BMJ* 374 (2021). https://doi.org/10.1136/bmj.n1734 arXiv:https://www.bmj.com/content/374/bmj.n1734.full.pdf

[3] Fiona Bell, Joshua Coffie, and Mirela Alistar. 2024. Bio-Digital Calendar: Attuning to Nonhuman Temporalities for Multispecies Understanding. In *Proceedings of the Eighteenth International Conference on Tangible, Embedded, and Embodied Interaction* (Cork, Ireland) *(TEI '24)*. Association for Computing Machinery, New York, NY, USA, Article 38, 15 pages. https://doi.org/10.1145/3623509.3633386

[4] Eli Blevis. 2007. Sustainable interaction design: invention & disposal, renewal & reuse. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (San Jose, California, USA) *(CHI '07)*. Association for Computing Machinery, New York, NY, USA, 503–512. https://doi.org/10.1145/1240624.1240705

[5] Lala Campos. 2019. beGROUNDED. https://class.textile-academy.org/2019/lara.campos/projects/Documentation/

[6] Michelle Chang, Chenyi Shen, Aditi Maheshwari, Andreea Danielescu, and Lining Yao. 2022. Patterns and Opportunities for the Design of Human-Plant Interaction. In *Proceedings of the 2022 ACM Designing Interactive Systems Conference* (Virtual Event, Australia) *(DIS '22)*. Association for Computing Machinery, New York, NY, USA, 925–948. https://doi.org/10.1145/3532106.3533555

[7] Kristin N. Dew and Daniela K. Rosner. 2019. Designing with waste: A situated inquiry into the material excess of making. In *DIS 2019 - Proceedings of the 2019 ACM Designing Interactive Systems Conference*. Association for Computing Machinery, Inc, 1307–1319. https://doi.org/10.1145/3322276.3322320

[8] Carl DiSalvo, Phoebe Sengers, and Hrönn Brynjarsdóttir. 2010. Mapping the landscape of sustainable HCI. In *Conference on Human Factors in Computing Systems - Proceedings*, Vol. 3. 1975–1984. https://doi.org/10.1145/1753326.1753625

[9] Paul Dourish. 2004. *Where the Action Is: The Foundations of Embodied Interaction*. MIT Press.

[10] Sandra Díaz, Josef Settele, Eduardo S. Brondízio, Hien T. Ngo, John Agard, Almut Arneth, Patricia Balvanera, Kate A. Brauman, Stuart H. M. Butchart, Kai M. A. Chan, Lucas A. Garibaldi, Kazuhito Ichii, Jianguo Liu, Suneetha M. Subramanian, Guy F. Midgley, Patricia Miloslavich, Zsolt Molnár, David Obura, Alexander Pfaff, Stephen Polasky, Andy Purvis, Jona Razzaque, Belinda Reyers, Rinku Roy Chowdhury, Yunne-Jai Shin, Ingrid Visseren-Hamakers, Katherine J. Willis, and Cynthia N. Zayas. 2019. Pervasive human-driven decline of life on Earth points to the need for transformative change. *Science* 366, 6471 (2019), eaax3100. https://doi.org/10.1126/science.aax3100 arXiv:https://www.science.org/doi/pdf/10.1126/science.aax3100

[11] Kate Fletcher. 2013. *Sustainable Fashion and Textiles: Design Journeys* (2 ed.). Routledge.

[12] Formlabs. 2018. Ceramic Resin V1 Usage and Design Guide. https://archive-media.formlabs.com/upload/ceramic-user-guide.pdf

[13] Sofía Guridi, Matteo Iannacchero, and Emmi Pouta. 2024. Towards More Sustainable Interactive Textiles: A Literature Review on The Use of Biomaterials for eTextiles.. In *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems* (Honolulu, HI, USA) *(CHI '24)*. Association for Computing Machinery, New York, NY, USA, Article 518, 19 pages. https://doi.org/10.1145/3613904.3642581

[14] Lone Koefoed Hansen and Margrete Lodahl Rolighed. 2024. Encountering Human-Plant Relations: a Discussion of How Interaction Design Can encourage Human Sensibility to More-than-human Plants. In *Proceedings of the 2024 ACM Designing Interactive Systems Conference* (IT University of Copenhagen, Denmark) *(DIS '24)*. Association for Computing Machinery, New York, NY, USA, 1400–1411. https://doi.org/10.1145/3643834.3661586

[15] Lon Åke Erni Johannes Hansson, Teresa Cerratto Pargman, and Daniel Sapiens Pargman. 2021. A Decade of Sustainable HCI: Connecting SHCI to the Sustainable Development Goals. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (Yokohama, Japan) *(CHI '21)*. Association for Computing Machinery, New York, NY, USA, Article 300, 19 pages. https://doi.org/10.1145/3411764.3445069

[16] Stephen Kaplan and Rachel Kaplan. 1989. *The experience of nature: A psychological perspective*. Cambridge University Press. https://www.hse.ru/data/2019/03/04/1196348207/%5BRachel_Kaplan,_Stephen_Kaplan%5D_The_Experience_of_(b-ok.xyz).pdf

[17] Sunyoung Kim and Eric Paulos. 2011. Practices in the Creative Reuse of e-Waste. 3478.

[18] David Kirsh. 2013. Embodied cognition and the magical future of interaction design. *ACM Trans. Comput.-Hum. Interact.* 20, 1, Article 3 (apr 2013), 30 pages. https://doi.org/10.1145/2442106.2442109

[19] Eric Klarenbeek. 2011. Mycelium Chair.

[20] Bran Knowles, Oliver Bates, and Maria Håkansson. 2018. This changes sustainable HCI. In *Conference on Human Factors in Computing Systems - Proceedings*, Vol. 2018-April. Association for Computing Machinery. https://doi.org/10.1145/3173574.3174045

[21] Susan Loh, Marcus Foth, and Yasu Santo. 2024. The more-than-human turn in human-plant interaction design: From utilitarian object to living co-inhabitant. *International Journal of Human-Computer Studies* 181 (2024), 103128. https://doi.org/10.1016/j.ijhcs.2023.103128

[22] Virginia I Lohr and Caroline H Pearson-Mims. 2000. Physical Discomfort May Be Reduced in the Presence of Interior Plants. *HorTechnology* 10 (2000), 53–58. Issue 1.

[23] Virginia I Lohr, Caroline H Pearson-Mims, and Georgia K Goodwin. 1996. Interior Plants May Improve Worker Productivity and Reduce Stress in a Windowless Environment. *Journal of Environmental Horticulture* 14 (1996), 97–100. Issue 2. http://www.anla.org

[24] Michael L. McKinney. 2002. Urbanization, Biodiversity, and Conservation: The impacts of urbanization on native species are poorly studied, but educating a highly urbanized human population about these impacts can greatly improve species conservation in all ecosystems. *BioScience* 52, 10 (10 2002), 883–890. https://doi.org/10.1641/0006-3568(2002)052[0883:UBAC]2.0.CO;2 arXiv:https://academic.oup.com/bioscience/article-pdf/52/10/883/26891997/52-10-883.pdf

[25] Maurice Merleau-Ponty. 1945. *Maurice Merleau-Ponty: Phenomenology of Perception*. Gallimard.

[26] Maurice Merleau-Ponty. 1964. *Signs*. Northwestern University Press.

[27] Hye Yeon Nam, Janiece Campbell, Andrew M. Webb, and Brendan Harmon. 2023. FloraWear: Wearable Living Interface. In *ACM International Conference Proceeding Series*. Association for Computing Machinery. https://doi.org/10.1145/3569009.3572801

[28] Yue Pan and Eli Blevis. 2014. Fashion thinking: lessons from fashion and sustainable interaction design, concepts and issues. In *Proceedings of the 2014 Conference on Designing Interactive Systems* (Vancouver, BC, Canada) *(DIS '14)*. Association for Computing Machinery, New York, NY, USA, 1005–1014. https://doi.org/10.1145/2598510.2598586

[29] James Pierce, Yolande Strengers, Phoebe Sengers, and Susanne Bødker. 2013. Introduction to the special issue on practice-oriented approaches to sustainable HCI. *ACM Trans. Comput.-Hum. Interact.* 20, 4, Article 20 (sep 2013), 8 pages. https://doi.org/10.1145/2494260

[30] Elena Sabinson, Isha Pradhan, and Keith Evan Green. 2021. Plant-Human Embodied Biofeedback (pheB): A Soft Robotic Surface for Emotion Regulation in Confined Physical Space. In *Proceedings of the Fifteenth International Conference on Tangible, Embedded, and Embodied Interaction* (Salzburg, Austria) *(TEI '21)*. Association for Computing Machinery, New York, NY, USA, Article 89, 14 pages. https://doi.org/10.1145/3430524.3446065

[31] Jonathan A. Scelsa, Gregory Sheward, Jennifer Birkeland, Jemma Liu, and Yun Jou Lin. 2023. Centripetal Clay Printing: Six-Axis Prints for Habitat Column. In *ACADIA*. 110–115.

[32] Jane Scott, Ben Bridgens, Romy Kaiser, Dilan Ozkan, and Armand Agraviador. 2023. The Living Room. In *ACADIA*, Vol. 2023. 208–219.

[33] Will R. Turner, Toshihiko Nakamura, and Marco Dinetti. 2004. Global Urbanization and the Separation of Humans from Nature. *BioScience* 54, 6 (06 2004), 585–590. https://doi.org/10.1641/0006-3568(2004)054[0585:GUATSO]2.0.CO;2 arXiv:https://academic.oup.com/bioscience/article-pdf/54/6/585/26895773/54-6-585.pdf

[34] Roger S. Ulrich. 1984. View through a window may influence recovery from surgery. *Science* 224 (1984), 420–421. Issue 4647. https://doi.org/10.1126/science.6143402

[35] Roger S. Ulrich, Robert F. Simons, Barbara D. Losito, Evelyn Fiorito, Mark A. Miles, and Michael Zelson. 1991. Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology* 11 (1991), 201–230. Issue 3. https://doi.org/10.1016/S0272-4944(05)80184-7

[36] UN. 2024. World Population Prospects 2024. www.unpopulation.org.

[37] Nancy M. Wells and Gary W. Evans. 2003. Nearby Nature: A Buffer of Life Stress among Rural Children. *Environment and Behavior* 35 (2003), 311–330. Issue 3.

[38] Edward O. Wilson. 1984. *Biophilia*. Harvard University Press.