Reinforcing and Reclaiming The Home: Co-speculating Future Technologies to Support Remote and Hybrid Work

Janghee Cho
Division of Industrial Design
National University of Singapore
Singapore
jcho@nus.edu.sg

Dasom Choi
Department of Industrial Design
KAIST
Daejun, South Korea
dasomchoi@kaist.ac.kr

Junnan Yu
School of Design
The Hong Kong Polytechnic University
Hong Kong, China
junnan.yu@polyu.edu.hk

Stephen Voida
Department of Information Science
University of Colorado Boulder
Boulder, Colorado, USA
svoida@Colorado.edu

ABSTRACT

With the rise of remote and hybrid work after COVID-19, there is growing interest in understanding remote workers' experiences and designing digital technology for the future of work within the field of HCI. To gain a holistic understanding of how remote workers navigate the blurred boundary between work and home and how designers can better support their boundary work, we employ humanistic geography as a lens. We engaged in co-speculative design practices with 11 remote workers in the US, exploring how future technologies might sustainably enhance participants' work and home lives in remote/hybrid arrangements. We present the imagined technologies that resulted from this process, which both reinforce remote workers' existing boundary work practices through everyday routines/rituals and reclaim the notion of home by fostering independence, joy, and healthy relationships. Our discussions with participants inform implications for designing digital technologies that promote sustainability in the future remote/hybrid work landscape.

CCS CONCEPTS

• **Human-centered computing → Human computer interaction (HCI)**.

KEYWORDS

work-from-home, boundary work, future of work

ACM Reference Format:
Janghee Cho, Dasom Choi, Junnan Yu, and Stephen Voida. 2024. Reinforcing and Reclaiming The Home: Co-speculating Future Technologies to Support Remote and Hybrid Work. In *Proceedings of the CHI Conference on Human Factors in Computing Systems (CHI '24), May 11–16, 2024, Honolulu, HI, USA.* ACM, New York, NY, USA, 28 pages. https://doi.org/10.1145/3613904.3642381

CHI '24, May 11–16, 2024, Honolulu, HI, USA

ACM ISBN 979-8-4007-0330-0/24/05.
https://doi.org/10.1145/3613904.3642381

1 INTRODUCTION

> Home is one of the greatest powers of integration for the thoughts, memories, and dream of mankind.
>
> Gaston Bachelard [5]

Home is often regarded as an exemplar of a place full of topophilia, meaning a profound love or attachment to a specific place, serving as a sanctuary for rest and quality time [104]. It offers a sense of belonging, privacy, security, and comfort, shaping our individual and communal identities [13, 38, 93]. After the COVID-19 pandemic, many have come to recognize the value of home as a workplace. Consequently, remote and hybrid work from home has become a "new normal," especially for information workers [61]. With more organizations embracing remote work, there has been a growing interest in comprehending remote workers' experiences and delineating a design space for digital technology to support their work within the field of HCI and CSCW (e.g., [20, 39, 49, 70, 97]). As work practices become integrated as an additional layer within the home environment, an opportunity arises to re-examine the potential roles of digital technology in helping information workers manage these multiple layers within a domestic setting, where individuals must navigate the demands of both work and home life.

While the importance of employees' well-being and work-life balance in remote work is widely acknowledged for its flexibility and inclusivity [40, 51, 99], a significant portion of HCI research has primarily focused on remote workers' productivity from an organizational and team perspective, including collaboration and social bonding with colleagues in remote settings [4, 17, 63]. Limited attention has been given to the sociocultural aspects of remote work, such as interactions with family members and the unique spatial configurations, despite their significant impact on work practices [20, 46]. Recognizing remote workers' multifaceted roles, not only as employees but also as individuals and members of households, is crucial for fostering sustainable work–life integration [1, 18, 40]. Building upon prior research that highlights remote workers navigating work-home boundaries through interactions with materials or cohabitants to achieve a balance between work and personal life [20, 87], this paper explores each individual's unique and nuanced experiences in remote and hybrid living and

working at home, envisioning future technologies that support work-from-home practices and enhance domestic routines.

Drawing upon the concept of place [38, 54, 104] from humanistic geography and a combination of qualitative and design studies including in-depth interviews, Cultural Probes [47], and Bespoke Booklets [35], this study explores how individuals' interactions with their surroundings shape their remote and hybrid experiences. Subsequently, by examining the social, cultural, and emotional constructs resulting from the meaning-making in remote work experiences at home, we discuss how technology can integrate into the home environment to promote the holistic wellbeing of remote workers. In other words, **how can designers construct better experiences that accommodate both work and personal life within the home, coexisting harmoniously?** Our work considers various dimensions of wellbeing, including subjective, meaningful, and social well-being [99], encompassing perceived productivity and work-family balance. As a result of employing participatory and speculative approaches, our work presented imagined technologies that could be leveraged or embedded in their remote/hybrid work arrangements from home. Our findings revealed that digital technology could have two main roles in supporting remote/hybrid work: *reinforcing* and *reclaiming* the meaning of home. These roles support transitions between work and home, facilitate productive work, and foster independent, joyful, and healthy lives within the home environment.

This research provides three primary contributions. First, our empirical data illuminates the personalized and distinctive ways in which individual remote workers negotiate boundaries to maintain a sense of normalcy and (re)gain a meaningful sense of place within their remote work practices at home. These insights, drawn from the lived experiences of each person, contribute to shaping the design and research space of remote work. Second, we expand the design space for digital technology in remote and hybrid work by co-speculating with participants to create a collection of imagined technologies. These insights can inform the HCI and CSCW communities in promoting sustainability in remote and hybrid work arrangements. Third, our discussion, grounded in empirical findings and design activities, contributes to the discourse on employee-centered remote and hybrid work modalities emphasizing flexibility, adaptability, and inclusiveness. Through our exploration, we examine the role of sociotechnical systems in fostering sustainable and successful remote work, recognizing their potential as a crucial component of the future of work.

2 RELATED WORK

In this section, we review existing research on remote work, including a theoretical background of boundary work and technology used in work-from-home arrangements with a focus on publications in the HCI domain. We conclude with a description of a theoretical background of human geography that informs our approach to understanding remote workers' experiences and generating insights for the design of digital technologies for remote work.

2.1 Boundary Work between Home and Work

Home and work are experiential, not merely physical, realms, molded by boundaries influenced by socio-cultural factors [13, 72]. People continually work toward some level of integration or segmentation by enacting, reinforcing, and modifying ideas of the meaning of work and home and how they should relate (i.e., *boundary work*) [72]. This interplay influences our identities and practices [53, 94].

Previous research has identified various boundary work practices among remote workers, encompassing spatial, temporal, and relational strategies [20, 24, 87, 101]. For instance, spatial boundaries involve creating dedicated home workspaces [2, 45], while temporal boundaries range from fixed work hours, such as a nine-to-five schedule, to a more flexible approach, where tasks are integrated with household chores [20, 51, 67]. Remote workers also manage relational boundaries as they balance roles as individuals, family members, and employees [40, 51, 67]. The importance of work-family balance has heightened for many information workers, especially after the COVID-19 pandemic [99]. Greenhaus et al. found that quality of life is positively affected when individuals prioritize family in work-life balance [50]. Work-family conflict affects work practices conducted from home, yet remote workers report satisfaction when tending to family needs during the day [46]. Given the intricate relationship between work and family, considering social and family dynamics is crucial in work-from-home practices.

Beyond these primary forms of boundary work, Cho et al. have highlighted that mundane sensory experiences, like natural light and everyday sounds, significantly influence how individuals perceive their environment and navigate boundaries [20]. Additionally, technology is employed to establish or maintain virtual and psychological boundaries as another means of achieving work-life balance [19, 20, 44]. For instance, remote workers often employ multiple devices or accounts to separate work from personal life. These boundary practices empower remote workers to harmonize their professional and personal lives, enhancing overall wellbeing [20].

People often establish routines or rituals[1] to switch between different domains and roles, delineating boundaries between home and work [3, 72]. These rituals often involve sociomaterial factors, such as co-habitants or possessions, serving as boundaries. While routines and rituals are sometimes used interchangeably, they carry distinct meanings. Routines primarily convey "this is what needs to be done," while rituals involve symbolic or cultural meaning and an affective commitment, conveying "this is who I am/we are" [10, 43]. Nevertheless, these repetitive practices can reduce uncertainty in everyday life by giving people more agency in managing their work and home life [43, 90, 92]. Routines and rituals are particularly valuable in situations where individuals face limitations in spatial or temporal resources, such as during sudden quarantine or isolation orders like those caused by the COVID-19 pandemic [20, 45, 92]. Building upon previous work which identified various strategies in boundary work, encompassing mundane, repetitive, and symbolic practices, we aim to deepen our understanding of how remote workers navigate and manage boundaries between their home and work spheres.

[1]There are spiritual or religious related rituals that represent a formal system of symbols, but our work focuses on more secular and mundane rituals involved with everyday work-from-home arrangements [10, 76].

2.2 Technology for Future of Remote and Hybrid Work from Home

While remote work has seen a significant surge among information workers following the COVID-19 outbreak, its existence spans decades (A more detailed history of and background about remote work can be found elsewhere, e.g., [6, 41, 55]). Historically, advancements in mobile and groupware technologies led to the increased adoption of remote work. Technologies such as personal computing and information communication technology (ICT) empowered employees to work flexibly [64, 78]. Adopting advanced technologies has often been considered a crucial strategy for achieving sustainable performance and health in remote and hybrid work settings [28, 71]. Given that technology usage is associated with remote workers' positive experiences at work [89], discussions on what technologies are needed and how they should be designed are the main focus of reimagining the workplace for the future of work [75, 99].

The future of work encompasses the evolution of work, workforce, and workplace concepts, including remote and hybrid work, in response to social and technological changes [27, 28]. It emphasizes the creation of *flexible, inclusive, and adaptable* work environments that cater to the diverse needs and aspirations of the workforce [7, 83, 99]. Remote and hybrid work are considered instrumental in achieving these goals and are expected to continue shaping the future of work.

In response to the dramatic increase in interest in remote and hybrid work during and after the COVID-19 pandemic, an increasing number of HCI and CSCW researchers have recently discussed the implications of designing technology for remote workers. When considering the concept of a home office and the pursuit of replicating traditional office infrastructure and social interactions to maintain a similar level of remote work productivity, much attention has been devoted to emulating established in-office arrangements (e.g., [4, 17, 63, 98]). In addition to online collaborative technologies, innovative tools like VR applications have been designed and developed to facilitate social interactions within online environments, with the aim of enhancing collaborative work and social engagement between coworkers.

In the context of the future of remote and hybrid work, prioritizing employee well-being and accessibility has also become increasingly important [27]. Das Swain et al. [32] found that mobile phones can enhance the flexibility and well-being of remote workers, proposing their use as tools to facilitate breaks during the day. Rudnicka et al. [85] also emphasized the importance of designing tools that foster social norms to promote breaks for physical health and productivity. With the emergence of new technologies, many organizations have recognized the need to make remote and hybrid work more accessible to their employees [12]. Consequently, recent work has investigated the work-from-home experiences of people with disabilities to support more inclusive work practices [31, 97].

While most studies have focused on how technologies can contribute to maintaining productivity in remote work settings, our work takes a more holistic perspective by investigating the nature of work in domestic environments and its integration with existing home practices, recognizing the blurred boundaries between the home and work spheres within the same physical space. Despite the significant impact of the home environment on remote work practices [16, 20], there is a lack of attention given to incorporating remote workers' relationships with their homes in envisioning digital technologies for remote work. By gaining a deeper understanding of how work effectively integrates with various facets of the home and vice versa, our objective is to investigate how technology can contribute to establishing sustainable remote/hybrid work arrangements.

2.3 Humanistic Geography Perspective on Understanding of Remote and Hybrid Work Configurations

Our research explores how remote workers navigate the home-work boundary as a process of creating meaning in their home environment. This investigation informs the development of future technologies aimed at enhancing remote workers' work-life balance. Designing technologies for domestic settings necessitates a profound understanding of the unique, personalized nature of the home environment [11, 20, 77]. To gain insight into boundary work within a remote/hybrid work setting conducted from home, we employ humanistic geography as our theoretical framework.

Tuan introduced humanistic geography to prioritize human values and intricacies in an understanding of geographical phenomena [103]. Humanistic geography draws on the concept of *sense of place*, referring to human consciousness, feeling, thoughts, and emotions toward a place that affects people's behavior, values, and attitudes [29, 104]. A *space* becomes a *place* by taking meaning in a cultural, individual, and social process.

A home is a place that we not only dwell in but also have existential connections [82]. From a humanistic geographical perspective, a home exemplifies a place characterized by a profound sense of care, attachment, and affection, often referred to as topophilia [105]. People's emotional bonds with their homes have been linked to a positive influence on their overall quality of life [73, 105]. This emotional connection is typically cultivated through familiarity, emotional attachment, aesthetic appreciation, and positive bodily experiences associated with that location [105]. In remote and hybrid work configurations, remote workers often establish a sense of place in their homes as part of boundary work, enabling them to respond to and make meaning of their home environments in ways that better support both their work and personal lives [20]. Therefore, in this work, we examine remote workers' boundary work practices, analyzing their interactions with the home environment from a sociocultural, emotional, and experiential perspective. We do so with the aim of envisioning novel technology that can support remote workers in cultivating a positive sense of home as they pursue healthy remote/hybrid work configurations within a domestic setting.

3 METHODS

Our study combines qualitative inquiry and design methods to explore how future technologies can enhance the wellbeing of remote workers in remote/hybrid work settings. Envisioning the future requires a deep understanding of the current socio-technical environment and a focus on everyday lives [36, 77, 80]. Therefore our work comprises two phases: *understanding* remote/hybrid work

experiences at home and *envisioning* digital technologies for the future of remote/hybrid work.

To examine the potential roles of technologies in remote/hybrid work, we initially investigated how remote workers manage boundaries between home and work in their everyday lives. We conducted in-depth interviews and used Cultural Probes [47] to understand participants' socio-cultural backgrounds and work-from-home experiences without requiring physical presence or synchronous observation. The Cultural Probes method, which involves a designerly way of knowing, allows us to collect inspirational data and authentic narratives from individuals [14, 47]. Given the familiarity of their surroundings, participants may not always be fully conscious of the intricacies and nuances of their home and work dynamics. Therefore, Cultural Probes served as a valuable tool to prompt participants to *bring unconscious aspects of their experiences to conscious awareness* [91, p.50].

Building upon the insights gained in the *understanding* phase, we employed the Bespoke Booklets method [35] to engage in co-speculative design practices with participants, envisioning digital technologies for remote/hybrid work. This method involves creating booklets of situated, imaginary, and personalized conceptual sketches inspired by people's everyday places and experiences. Given that many digital technologies for remote/hybrid work often reflect organizational values, this participatory and speculative approach is appropriate for our envisioning practices. It allows us to amplify the voices of remote workers, explore alternative technology possibilities from multiple perspectives, and address ethical considerations in socio-technical system design [95]. While other in-person methods like design workshops or home tours were options, we chose remote-available methods to include participants from different locations and consider the ongoing impact of the COVID-19 pandemic, including health concerns.

Our research protocol was reviewed and approved by the IRB at the institution in the USA.

3.1 Recruitment

We recruited participants from February to May 2022 through our personal networks, social media, and online communities in which remote workers shared their work-from-home experiences and tips by deploying a pre-screening survey. Work can be interpreted in various ways depending on personal situations or perspectives. For instance, household labor performed by family members is regarded as home-based work, involving physical or mental efforts to produce something for a specific purpose. In the pre-industrial age, the definition of work was generally more expansive and varied compared to the post-Industrial Revolution era [23]. In this study, we align with a contemporary understanding of work that emerged with industrialization, with a primary focus on employment—work done for pay or profit [60, 74]. Guided by this perspective, participants were recruited across geographical locations in the US. We focused on recruiting remote workers living with co-habitants (e.g., children, partners) needing help with errands or tasks, because recent studies have shown that remote workers' quality of life and work often hinge upon the layout of their workspace and whether they lived with others [20, 100]. For example, older males without childcare responsibilities reported more positive work-from-home experiences compared to those balancing work with caregiving duties. Conversely, individuals living with family members often had limited resources and autonomy to control their space, time, or interactions within the household. This situation placed greater demands on their boundary work and role transitions [20]. We ended up recruiting 11 participants who have different home arrangements and permutations of co-habiting household members (Table 1). They were compensated with a $70 gift card for completing all two phases.

3.2 Study Procedure: Data collection & Analysis

In this section, we outline the research design and procedures for the understanding and envisioning phases (see Figure 1 for a detailed procedure breakdown). For reference, interview protocols and prompts for the Cultural Probes (e.g., Instructions for participants' photos) and Bespoke Booklets can be found in the supplementary files.

3.2.1 Phase 1: Understanding. After obtaining consent, we conducted pre-interview sessions where we provided an overview of the study and conducted semi-structured interviews. These interviews aimed to understand remote workers' experiences while working from home, focusing on their background, home environment, time management practices, household members, technology use, and daily routines/rituals. We utilized conversational interviewing techniques [106] and non-directive approaches [76] to collect experiential narratives. The interviews, conducted via video conference by the first author, lasted between 20 to 50 minutes, and were audio-recorded and transcribed for analysis.

After the interviews, we used cultural probes to capture participants' everyday practices, tacit knowledge, and implicit cues related to their home and work experiences, which can be challenging to articulate during interviews. The cultural probe kit, including postcards, graph paper, stickers, and an instant camera, encouraged participants to engage in open-ended, evocative, and playful activities. Participants were asked to photograph their possessions and surroundings, and create sensory and relational maps based on their experiences. The probe kits were deployed and retrieved by mail or in person. We encouraged participants to complete the tasks within a two-week timeframe, although some participants required four weeks due to personal circumstances. The data collected, including text, photos, and floor map drawings, was digitized for analysis.

To examine the everyday experiences of hybrid and remote workers in their homes, we employed an inductive, qualitative analysis [15]. We conducted open-coding of interview transcripts, cultural probe materials, and participant-provided photos. We used structural (e.g., Challenges, Routine), descriptive (e.g., Cooking), and process (e.g., Leveraging furniture) codes [88]. Although inductive, our open-coding was influenced by our theoretical understanding of boundary work and humanistic geography [15]. We sought to capture unique and idiosyncratic aspects of participants' work practices to facilitate a more inclusive discussion in designing technology. In the second phase of analysis, we conducted focused coding [88], placing emphasis on our main research interests: how remote workers conceptualized their homes and their relationships with the socio-cultural components of home to maintain productivity and simultaneously achieve well-being. Specifically, we focused

Table 1: Participants' Backgrounds

	Age group	Gender	Occupation types	The number of household members	A dedicated home office
P1	25 to 34	Female	Graduate student	2	No
P2	35 to 44	Female	Self-employed (Consulting)	2 (with a pet)	Yes
P3	18 to 24	Female	Graduate student	2 (with a pet)	Yes
P4	25 to 34	Male	Finance	3	Yes
P5	25 to 34	Female	Customer Service	6 (with pets)	No
P6	35 to 44	Male	Graduate student	4	No
P7	45 to 54	Male	Information technology	5	Yes
P8	55 to 64	Male	Telecommunication	2 (with a pet)	Yes
P9	35 to 44	Female	Researcher (Industry)	3	Yes
P10	35 to 44	Female	Researcher (Academia)	4	No
P11	25 to 34	Female	Social worker	2 (with pets)	Yes

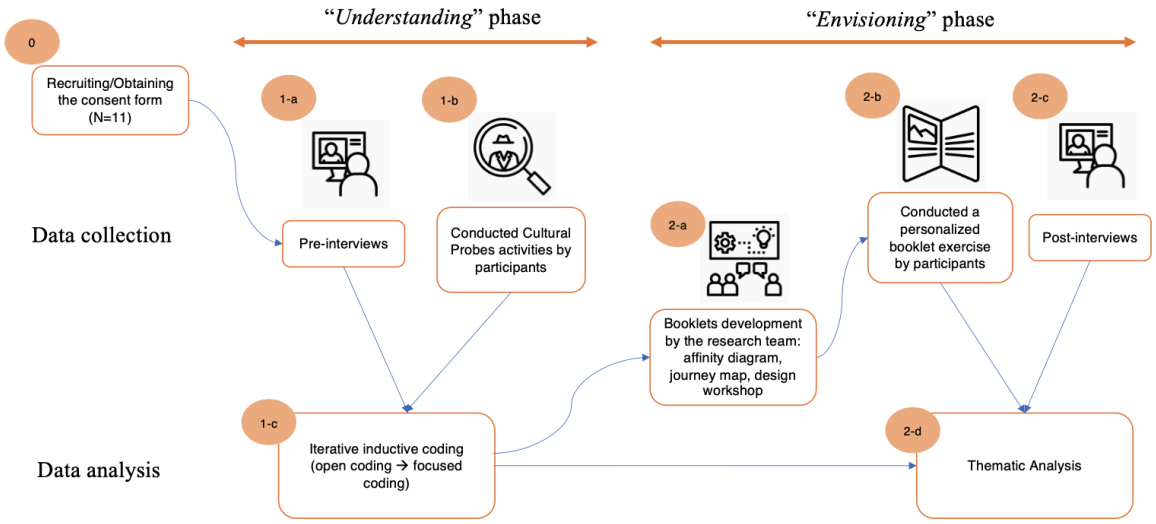


Figure 1: Study Procedure for Two Phases: The duration of this process varied among participants due to individual circumstances and mailing timeframes but averaged 11-14 weeks. These steps included conducting interviews, involving participants in design activities, creating personalized booklets by the research team, and managing the mailing and receipt of research materials.

on how participants leveraged diverse resources that shape a sense of place of home, such as objects, bodily experiences, cohabitants, or rooms, to engage in boundary work practices.

3.2.2 Phase 2: Envisioning. Building on the insights gained from phase 1, we crafted personalized handbook-style booklets for each participant, enabling them to envision potential technologies for remote work and home. To inform the booklet's content, we conducted further analysis by reorganizing key themes and aspects identified in phase 1. For each participant's data, we utilized an affinity diagram, inspired by a situational map [25], to capture the intricacies of their domestic lives. We also developed journey maps [42] to gain a deeper understanding of participants' daily routines and repetitive practices. Subsequently, our team conducted internal online design workshops using tools like Figma Jam boards and Mural[2] to create bespoke booklets tailored to each participant.

Combining Desjardins et al.'s four qualities of Bespoke Booklets (*collaborative, post-functional, situated,* and *partial*) with insights gathered in phase 1, the research team seeded imagined technologies in the booklet, including both sketched images and narrative descriptions derived from the results of the affinity diagram and journey map activities. We also included empty pages for participants to counter-propose their own novel technologies, seeded with photographs of spaces from each participant's own home (Figure 2). On average, each participant interacted with 10 imagined technologies: half designed by the authors using information from phase 1, and the other half proposed by participants themselves.

[2]A sample of design workshop materials is available in the supplementary document

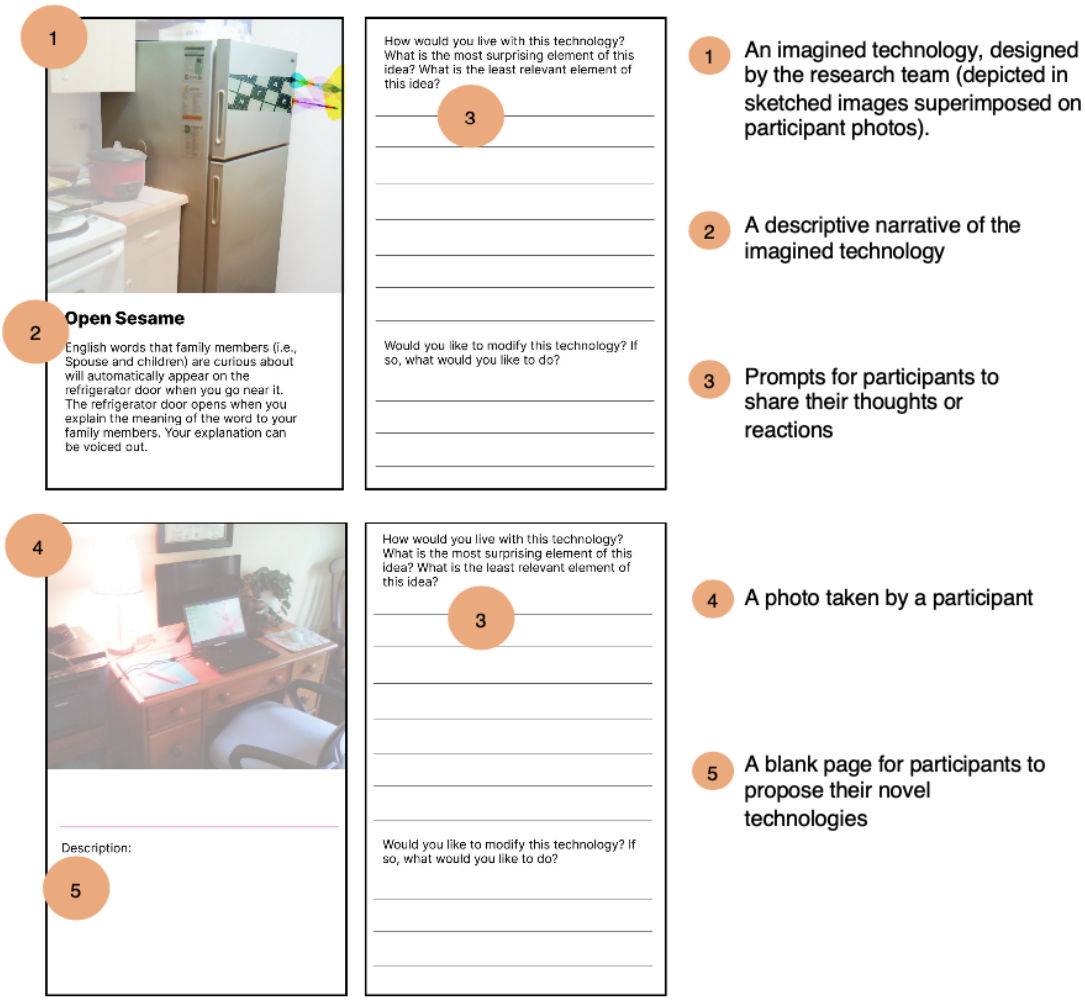


Figure 2: In the personalized booklet, each participant encountered a set of imagined technologies (5-6) crafted by the research team, along with prompts to elicit their opinions and reactions. Each imagined technology was accompanied by a description and related prompts, urging participants to express their thoughts and engage in reflective practices. While formulating these descriptions, our emphasis was on situating the technology within its context, rather than delving into technical specifics or data collection processes (as shown in the two images above). Furthermore, participants were presented with a series of photographs and blank pages (4-5) where they could propose their own imagined technologies. Similar prompts were provided to encourage thoughtful consideration of their designs (as depicted in the two images below).

Our intention in creating these booklets was to encourage thought-provoking discussions with participants. To achieve this goal, we made extensive use of speculative sketches overlaid on photos taken by participants of their homes to show how these imagined technologies might be situated. We envisioned these sketches as a *mise-en-scene* at home, designed to act as new props that could represent alternate experiences in remote/hybrid work arrangements. By employing open-ended prompts (Figure 2), we encouraged participants to introspect on their ideas about imagined technology, capturing their reactions and thoughts rooted in the components we and they envisioned. Like the cultural probes, the booklets were distributed and retrieved by mail or in person. Participants spent one or two weeks conducting booklet activities.

After all other research activities were complete, we conducted post-interviews with each participant. During these interviews, we asked participants what they had learned about their work, cohabitants, and home after participating in our study. We also continued discussions about the imagined technologies, including those designed by us and those suggested by the participants

themselves. These post-interviews, conducted remotely by the first author, typically lasted around 20-50 minutes.

To analyze the data from the booklets, we first digitized all the raw data from the booklets, including participants' text responses and sketches and the transcripts of our post-interviews. In our analysis, we employed thematic analysis [15] to identify and elicit the potential roles of digital technologies in remote and hybrid work settings. To provide context and deepen our analysis, we referred to our understanding of each participant, which was developed during the data analysis in phase 1. This entailed considering how the imagined technologies addressed participants' challenges and aligned with their specific needs and circumstances (e.g., no dedicated space for work). Additionally, we examined the relevant aspects of the home that inspired our design concepts (e.g., sensory experiences). We also explored how the imagined technologies might impact participants' remote work experiences and whether they were primarily focused on individual needs or involved social aspects within the home environment. By considering all these factors, we aimed to gain a comprehensive understanding of the possibilities and implications of digital technologies in supporting remote and hybrid work scenarios.

4 FINDINGS: UNDERSTANDING THE CRAFTING OF A PRODUCTIVE HOME ENVIRONMENT

This section presents the empirical findings from the analysis of the data gathered from phase 1. While some participants continue to face remote/hybrid work challenges at home, most have adapted well since the onset of COVID-19–mandated remote work, achieving stability by incorporating routines and rituals into their boundary work and utilizing the materials, sensory cues, and social components of their home environment. Below, we provide a detailed examination of how they shape participants' sense of home to create a suitable environment for both work and living, as well as challenges they have encountered. Detailed examples can be found in the Appendix.

4.1 Sense of Normalcy: Establishing Boundaries Through Routines and Rituals

In traditional office settings, information workers often rely on a clear example of boundary work, commuting, to start or end their workday [3]. In contrast, remote workers must develop their own strategies to delineate the boundary between work and home life. One common approach that participants employ involves establishing a repetitive and sequential behavioral pattern that facilitates transitions between work and home. For instance, morning routines and rituals such as making tea or engaging in social interactions with family members serve as foundational elements that shape participants' mindset and establish a distinct boundary between home and work (These and additional examples can be found in Figure 4 and 6). Through these meaningful practices, participants can initiate or conclude work or simply take breaks to maintain a work–life balance. We also found that female participants, in particular, perceive household labor as a repetitive routine, leading them to navigate boundary distinctions between work and home. For instance, dinner preparation emerged as a natural means for female participants to momentarily detach from work. Additionally, a few female participants highlighted the practice of multitasking, such as attending to laundry during breaks, which contributes to a porous boundary between the home and work domains (see Figure 7.b). This routine-driven sense of normalcy and security enables participants to sustain a remote work mode.

4.2 Sense of Attachment: Cultivating Emotional Bonds With a Space Through Sensory Experiences and Personal Possessions

We also found that participants capitalize on the benefits of working from home by incorporating personally meaningful possessions and enjoying sensory cues from their home environment. Those with dedicated home workspaces have greater control and agency in configuring their work environment for increased productivity. These practices highlighted participants' intentional efforts to craft a meaningful workspace that not only facilitates their work but also reflects their individual preferences. Participants also engage in various sensory experiences during their everyday work-from-home routines, contributing to positive and productive days. Specifically, participants find joy and contentment in nature, whether visually or auditorily. These practices foster a sense of attachment and familiarity [105], ultimately enhancing their overall well-being and remote work productivity (detailed examples appear in Figure 5).

4.3 Sense of Kinship: Fostering Connections With People Within the Home

While cohabitants may not be work colleagues and often do not share the same social sphere as other employees (unless they happen to work for the same company), the social dynamics at home significantly impact people's work practices [20]. We also found that the presence and interactions of household members significantly affect remote workers' work practices, including boundary establishment and space utilization. Particularly, those living with partners, who are both working from home, emphasize the importance of taking breaks together for social interactions during work (e.g., Figure 7.c). The presence and activities of family members facilitate a sense of closure and transition at the end of the day. This allows remote workers to shift from their employee role to that of an individual and/or family member, effectively distinguishing between work and personal domains (e.g., Figure 6.a,b). Participants with experience in parenthood are more likely to be influenced by their children in defining their boundaries. We observed that non-U.S. citizen participants (P4, P6) living with children are more inclined to interact with them frequently during work hours (e.g., Figure 7.a). Embracing the social component of their home environment, participants maintain a healthier orientation in remote and hybrid work environments.

4.4 Challenges in Remote/Hybrid Work From Home

Despite the widespread adoption of remote/hybrid work, we have identified two primary ongoing challenges faced by some participants: (1) time management and (2) managing the overloaded nature of their physical spaces.

While the majority of participants reported that it is relatively easy to stop working at a specific time, a few individuals described difficulties in detaching from work due to the blurred boundaries between their work and homes. This challenge is a common issue in remote and hybrid work scenarios, further exacerbated by the proliferation of 'always-on' technologies [46, 62]. Some participants mentioned they intentionally try to be away from a mobile after work (e.g., *'You definitely need to have some controls on your mobile phone. That way, you are not constantly checking for emails. If I do respond to it, people get the impression that "Oh, he's available anytime I want." right? So, I think setting boundaries very cleanly is the important part.'* (P7)). However, this difficulty was particularly notable in cases where the nature of their work, centered around research within an academic setting, provided flexibility in time management. P10 noted that when engrossed in an engaging research project, she tends to extend her work hours. P3 experiences pressure due to the absence of clear key performance indicators for graduate students, resulting in a constant need to be available. Interestingly, participants in industry settings, spanning research roles to other functions, exhibit more control over their temporal boundaries, effectively transitioning between work and home.

Many remote workers have dedicated workspaces that provide clear physical boundaries between work and home; however, several of our participants (examples can be found in Figure 8) have had to conduct their work in communal areas like dining or living rooms, necessitating a constant negotiation of the permeability of the borders between home and work [24]. Using personal or family spaces as work areas has led to discomfort with work-related items being scattered throughout their homes. Sometimes, the absence of a dedicated workspace has resulted in conflicts with other household members. Nevertheless, some participants have taken a proactive approach to transforming specific areas into suitable work environments by investing in furniture or engaging positively with other household members.

5 FINDINGS: ENVISIONING DOMESTIC TECHNOLOGY WITH REMOTE WORKERS

In this section, we present the imagined technologies generated by our research team and the participants in the bespoke booklets, building upon the insights gained from our examination of participants' boundary work in Section 4.

5.1 Technologies for Transitions Between Home and Work

Through dialogues with participants, we found that technologies have the potential to help remote workers transition between home and work. They do this by either reinforcing existing routines and rituals or by introducing new ones to create a distinct sense of home.

5.1.1 Technologies Situated in 'Start-up' Routines. We introduced several imagined technology ideas centered around participants' morning routines and rituals in response to temporal and spatial boundary work reported in 'starting up' at the beginning of the workday. In response to P3's tea-brewing ritual (Figure 4.b), we introduced the *Fortune Cookie Cup* (Figure 3), which offered inspiring aphorisms when filled. However, P3 expressed a preference for seeing her daily to-do list on the cup instead of an inspirational quote. She believed that seeing her tasks for the day would lower her anxiety and help her set realistic expectations. P3 pointed out that the act of making and consuming tea itself already brings her a sense of calm and readiness to work, highlighting the importance of understanding individual preferences and the symbolic meaning of repetitive practices. Similarly, P9 enjoyed tea as part of her workday routine, finding the aroma significant. Given her fondness for this sensory cue, we introduced the *Fragrant Fabric* (Figure 9.A) concept, which aimed to enhance her morning routine by emitting tea scents captured at meaningful moments. However, P9 questioned the concept, highlighting the importance of physical sensations like cup warmth and rising steam, not just fragrance. According to P9, *'It's the experience of the green tea...the fact that it's hot, that I can wrap my hands around it, the steam coming up in front of me, you know, it's really the experience. The fragrance itself is not exciting to me.'* (P9). This highlights the importance of considering multiple sensory components to fully immerse users in their routines.

When designing transition-supporting technologies, it's vital to consider participants' individual backgrounds and situations. For instance, P5 has a morning ritual of checking social media and the news due to her general anxiety disorder and worsening asthma, post–COVID-19. Considering her health issues, we introduced the *Breathing Screen* (Figure 9.B) as a tool to help her take deep breaths and provide soothing sounds when encountering distressing news during her morning news-checking ritual. P5 responded positively to this design proposal, expecting that guided breathing practices would help to reduce her stress at the start of her day. Additionally, we introduced the concept of the *Happy Mail Box* (Figure 9.C), providing uplifting news during her morning walk with her cat, easing morning stress related to negative news. P5 confirmed that a technology of this type might help her start the day with a more positive frame of mind by alleviating morning stress related to negative news exposure.

We also explored participants' preferences for integrating natural elements into their morning routines, which significantly contributed to their positive sense of place. For example, P1 shared how the sound of birds made her feel calm and content, but lamented that she could only have this experience when waking up (unusually) early. When she woke up late, the soothing sounds were overshadowed by the noise of traffic. In response, we introduced the *Morning Capsule* (Figure 9.D), a device that records and plays back bird songs, allowing users to enjoy them even when rising later. P1 considered the design and shared her preference for having the bird song play on a speaker in her bedroom rather than in the proposed capsule form factor. It became apparent that leveraging a familiar object, like a speaker, would be more beneficial for engaging with the natural element of birdsong, deviating from the initial "time capsule" metaphor used in the design of the *Morning Capsule*. Similarly, P6 reported finding calmness and relaxation in outdoor sounds at the beginning of his workday. To enhance this experience, we proposed the *Ambient Hometown* (Figure 9.E), which enriches his workspace with natural sounds and photographs of his hometown triggered by morning sounds. Inspired by his home

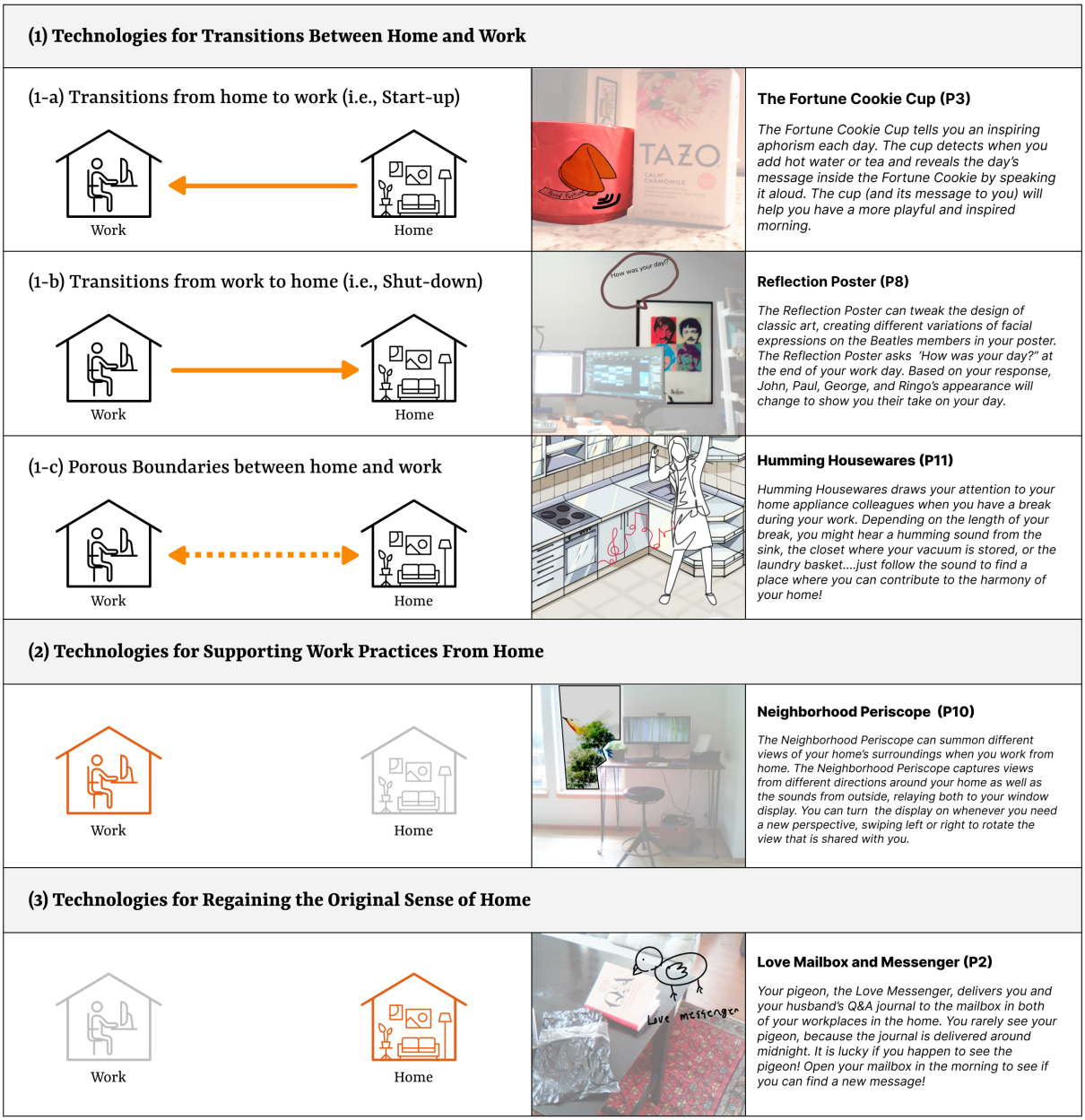


Figure 3: Five potential deployments of digital technology in remote/hybrid work settings and illustrative examples from booklet activities

country's unique climate, we focused on incorporating climate-related natural sounds to evoke a sense of home. Technology is commonly seen as a means to alleviate homesickness [58]. This approach resonated with P6, who mentioned that he would use it to connect with his hometown when he misses it. Participants seek to blend their homes with nature's beauty, creating rituals that celebrate joy and resonate with personally meaningful aspects of their lives.

5.1.2 Technologies Situated in 'Shut-down' Routines. Technologies can also support remote workers' existing "shut-down" routines, which help separate work from home at day's end. With the presence and activities of family members in mind (as discussed in Section 4.3), several ideas were proposed to enhance remote workers' roles as household members. For example, we introduced the *Chameleon Photo Frame* (Figure 10.A) to P7, which gradually changes his family photos as he nears the end of work, thereby

drawing his attention to his family role. The frame also detects the sounds of his children arriving back home, making the pictures more vivid. P7 expressed great satisfaction with this concept and suggested using it as an automatic screen saver for his monitor: *'I do think this is a really cool idea, though... If it could be used as a secondary screen for work, that would be cool'* (P7).

To further facilitate the separation between work and home roles, we presented P7 with the *Magic House Map* (Figure 10.B), which visually displays upcoming housework tasks and the corresponding tools needed at the end of his workday. While P7 found the idea evocative and anticipatory, he suggested adding a short downtime period, allowing individuals to step away from both their employee and father/husband responsibilities. This serves as a mental bridge between work and home since he no longer commutes for reflection. This case highlights the importance of integrating personal interests and creating protected windows of personal time during "shut-down" routines.

Like household members, pets also play an important role in helping remote workers establish clear boundaries between work and home (e.g., Figure 6.b). Drawing inspiration from this, we presented P3 with the *Time to Pet Me* (Figure 10.C), which helps foreground a dog's needs, prompting the owner when it's time for a walk. P3 expressed satisfaction with the concept, stating its potential to improve the work–life boundary. However, she noted the importance of tailoring this technology to her dog's personality, mentioning that her dog tends to be quiet and doesn't typically demand outdoor time throughout the day.

Preparing dinner is a common everyday practice that individuals, especially female household members engaged in remote work from home, naturally transition to after remote work (e.g., Figure 6.c). To make this transition more enjoyable, we introduced the *Food Punch Machine* (Figure 10.D) for P11. This machine showcases dishes from random cities or countries, providing P11 with serendipitous inspiration for her cooking. She embraced the idea of exploring international cuisines and considered using a meal delivery service to receive a variety of ingredients, making her post-work routine more enjoyable. While the degree of technology's visibility in existing routines may vary, establishing routines that allow remote workers to express their authentic selves is crucial for a seamless disengagement from work. Participants showed a greater willingness to incorporate technology into their boundary work when it was associated with enjoyable activities, such as cooking. This highlights technology's potential to support an emotional connection, allowing remote workers to focus on aspects of themselves beyond their employee role. This reconnection with the essence of home, characterized by comfort, care, and familiarity, facilitates a smooth transition between work and the comforting realm of home.

We also found that leveraging personally meaningful possessions in the workplace could help remote workers in wrapping up their work. For instance, a photo of P8's home workplace displayed a guitar and a poster of a band, reflecting his individual identity and preferences. Building upon his attachment to these items, we proposed a *Reflection Poster* (Figure 3), which adjusts the facial expressions of the depicted band members based on P8's reflections about his day. Through this introduction of new end-of-day rituals, our goal was to help P8 conclude his work with a sense of fulfillment. P8 responded positively to the idea, stating, *'It would put a smile on my face regardless of the type of day I had'* (P8). This success in fostering daily reflection by encouraging interaction with everyday objects [68] highlights the potential of objects as symbolic representations of self. By emphasizing an object's meaning rather than its utility alone, we found that it was possible to support a reflective practice that concludes work while embracing an individual's playful and joyful aspects of personality.

To assist individuals struggling to establish clear boundaries to stop working in remote work settings, we introduced conceptual technologies to participants to explore their potential in facilitating transitions. For example, we presented the *Grumpy Hard Drive* (Figure 10.E) to P10—a device that emits increasingly louder whirs and grumbles when she exceeds her planned work duration. Our aim was to create a technology that utilizes auditory cues to remind her of the passage of time and her initial time-related intentions and commitments. Instead of relying on information-driven technology, which might display time usage or daily goals to aid in time management, we opted for an everyday object with specific sensory experiences, especially tailored for P10. Our observation revealed P10's sensitivity to objects, aesthetics, and sensory elements in her workplace compared to other participants. This approach was designed to stimulate her reflection on time usage for work. P10 responded positively to the design and suggested an additional feature to support short breaks throughout the day, saying, *'I would like it as an external reminder to stop working.... I appreciate the idea of our technology needing breaks. The hard drive could signal me to take unexpected breaks during the day.'* (P10). Moreover, she expressed interest in considering her tool's perspective to gain a better understanding of her situation. This perspective motivates her to reevaluate her time management practices and strive for overall wellbeing.

5.1.3 Technologies for Supporting Porous Boundaries Between Home and Work.

Porous temporal and spatial boundaries are an essential characteristic of remote and hybrid work. We also presented several imagined technologies to support this unique characteristic. For instance, we introduced the concept of *Humming Housewares* (Figure 3) to P11, a design that causes home appliances to emit humming sounds based on the anticipated length of her break. This system helps her identify suitable household tasks that she can complete while stepping away from work. P11 appreciated this creative approach to making break time more enjoyable and believed it would enhance her daily productivity. She also suggested including a notification function on her cell phone to manage interactions and easily access an available task list.

P11 also proposed a couple of technologies to help her take breaks during work. She mentioned that she has been working overtime recently and acknowledged, *'I just don't take enough breaks; I end up hungry for like an hour'* (P11). In response to this, she suggested *Creative Outlet Crochet* (Figure 11.A), a system that alerts her when she has been working intensively for an extended period, encouraging her to take a break. The use of crocheting tools makes her feel productive as an individual, so being prompted by them could help alleviate any guilt associated with taking a break while working. Engaging in her preferred practice helps her relax and return to

work feeling refreshed. This innovative approach embraces her personal interests and redefines the way she claims her break time.

Additionally, We introduced a concept to P10 called *Household Pomodoro* (Figure 11.B) to help her maintain regular breaks and enhance her household contributions throughout the day. Since she often uses the Pomodoro technique [22] to allocate focused work time, *Household Pomodoro* emits an alarm, for instance, from her kitchen, to prompt her to accomplish tasks that engage a different aspect of her identity during her breaks. While P10 appreciated the idea and recognized its usefulness for days with many smaller tasks, she expressed a desire for alternative break methods. She suggested a technology that offers daily challenges, such as going out to take pictures of clouds or trees, as a way to promote better self-care throughout the day instead of reminding her of household labor during the day.

Another example we created is *LEGO Hunter* (Figure 11.C) for P9, which reinforces her positive experiences of using walks as a mental reset and to embody her love for building LEGO sets. This design customizes a LEGO brick based on P9's walking data, a design for which she expressed strong enthusiasm. For P9, LEGOs represent relaxation, and she expressed a desire to use a technology that incorporates the physicality of LEGO bricks for a more playful approach to reflecting on her activities and experiences: *'...this LEGO really resonates with me. If I had a LEGO brick that could help reflect how I feel or track the number of miles I've walked... It's all about playfulness, you know, something that brings joy'* (P9). Remote work allows for the interleaving of various tasks and responsibilities from home. Technology can support these porous boundaries in a more enjoyable manner. This can be achieved by incorporating personally meaningful practices or playfully facilitating household chores during the day.

In line with this objective, we proposed the *Emotional Thermometer* (Figure 11.D) to P4, who often switches his roles between being an employee and a father during work. While he appreciates the flexibility of spending short amounts of time with his daughter during work, he also experiences stress when her play sounds interrupt meetings. To address this situation, we aimed to highlight the positive aspect of remote work, which is the opportunity to strengthen the bond with his daughter. The *Emotional Thermometer* displays the degree of emotional connection between P4 and his daughter. In response to this concept, P4 expressed interest in assessing the quality of time they spend together due to the remote work arrangement. By enhancing social relationships, which play a significant role in shaping perceptions and attitudes towards the home as both a working and living space, technologies can contribute to a more fulfilling and balanced remote work experience.

5.2 Technologies for Supporting Work Practices from Home

In this section, we present imagined technologies that enhance participants' work experiences by shaping their home arrangements and routines. We begin by illustrating how these technologies help participants reclaim the meaning of home, fostering resilience in their remote work environments through symbolic practices. Following that, we explore how these technologies create a positive and engaging atmosphere, enhancing productivity by aligning aspects of the home with participants' established work routines.

5.2.1 Technologies for Reimagining Spaces for Remote Work. We found that technologies could enable individuals to reinterpret the meaning of specific home spaces, transcending the rational aspects of modern housing design [66]. This reinterpretation allows for the effective utilization of these spaces for work, contributing to the enhancement of resilience in remote work practices.

For P1, who experiences spatial tension when using the dining room as a workplace (Figure 8.c), we proposed technologies to encourage her to reconsider the meaning of the living room and change her perceptions of this under-utilized space. One example is *Magical Hopscotch* (Figure 12.A), which creates a virtual grid connecting the living room and the bedroom, making it easier and more appealing for her to see the living room as an extension of her personal space for work and rest. Another example is the *Elastic Living Room* (Figure 12.B), which displays personal items in the living room, creating a more comfortable environment for P1. These concepts aimed to enhance accessibility to the living room for P1 and provide alternative ways to experience the communal space. After considering our design proposals, P1 remarked, *'I noticed I could have made use of them, the living room, for example, to do certain tasks. I didn't have to get a sticking place that was just the table in the dining room'* (P1). Inspired by our proposal, she responded with her own imagined technology, the *Tactile-Changing Carpet* (Figure 12.C), aimed at making her living room experiences more playful. This interactive carpet can change its softness, allowing people to feel different materials like sand, porcelain, or fur based on their choice. After engaging in these imaginary activities, she noticed a new way of utilizing places in her home: *'My everyday experience becoming more aware of what's happening around me... my space is just my bedroom and then they [design practices] made me feel like "Oh the home would be more like, my space not just my bedroom where that where I sleep"'* (P1).

While some participants have dedicated workspaces, imagined technologies can help them utilize additional spaces for work, as well. For example, P3 envisioned technology that combines real and augmented reality plants to create a nature-inspired patio atmosphere (Figure 12.D). This immersive experience eliminates concerns about plant care and fosters a tranquil outdoor setting, encouraging open-air work. It enables P3 to use various spaces for work, creating more opportunities for diversity and comfort in home-based work.

Furthermore, in our exploration of utilizing different spaces for work, we introduced the *Togetherness* concept (Figure 12.E) to P5, aiming to foster a more collaborative atmosphere in the living room (Figure 8.e). This concept is attached to each housemate's laptop and emits different colors based on the content of their ongoing conversations with customers. We anticipated that 'Togetherness' would promote awareness of each other's situations, facilitate interactions during work, and serve as a means of supporting one another through tacit communication. P5 greatly appreciated this design concept. In fact, she and her housemate even purchased two different colored dolls to manually indicate their conversation status with customers, inspired by our proposal.

Through these design-oriented discussions, we gained valuable insights into the transformative power of technology in enhancing participants' experiences and strengthening their emotional connection to specific spaces. By prioritizing personalization and creating technologies that enhance pleasantness, we observed how individuals could reclaim and redefine the meaning of certain spaces. This, in turn, unlocked new possibilities for configuring physical environments to effectively support remote work from home.

5.2.2 Technologies for Enhancing Work Productivity. In this section, we present imagined technologies designed to support remote work practices at home, focusing on improving productivity and aligning with participants' routines by leveraging their sensory experiences or possessions. These technologies focus on enhancing self-care, fostering a sense of fulfillment, and promoting well-being to create a conducive work environment.

We explored ways to enhance sensory experiences during work to boost productivity, drawing inspiration from Section 4.2. For example, P10 often enjoys watching the outdoors through her window while working. To accommodate this preference, we proposed the *Neighborhood Periscope* (Figure 3), a device that captures views and sounds from around the home and relays them to the participant's window. In response, P10 expressed a desire to incorporate soothing sounds to accompany the visuals, such as birdsong, stating, *'the bird sounds or whatever is just very calming and makes you feel part of the world, rather than kind of closed off'* (P10). Additionally, P7 suggested the *Seasonal Zen Garden* (Figure 13.A) to manage work time naturally by representing time and task progress through a growing and changing tree artifact.

To enhance task support, participants envisioned various technologies aimed at streamlining workflows, improving efficiency, and optimizing productivity. P8, for instance, proposed five functional technologies to enhance his remote work experience, emphasizing the importance of connectivity. One example is the *Home Wide Computer* (Figure 13.B), enabling him to connect monitors, TVs, mouse, and keyboards from anywhere in his home. P3 introduced the *Distraction Free Zone* (Figure 13.C), an embedded screen control app that prevents access to distracting websites to maintain focus. Additionally, P9 suggested a design called *Batwing* (Figure 13.D), a personally meaningful object that changes color based on task progress. Participants also contributed ideas to boost productivity, with coffee being a key factor. P2 introduced the *Temperature Steady Coffee Cup* (Figure 13.E), which maintains coffee at an ideal drinking temperature until 11 am and then absorbs any remaining coffee at a set time, preventing excessive caffeine consumption in the afternoon.

By considering both the affective and functional aspects that impact overall productivity, digital technologies can be customized to align with individuals' preferences, established routines, and existing technological infrastructure at home, thereby increasing their effectiveness in remote work environments.

5.3 Technologies for Regaining the Original Sense of Home

As remote work infiltrates the home environment, some participants strove to preserve the original essence of their homes (e.g., Figure 8.a). For example, P10, who uses her dining room as a workspace, proposed two speculative technologies to maintain a home-centric feel in this shared space. She introduced the *Artistic Hard Drive* (Figure 14.A), which resembles a sculptural piece integrating work equipment into the dining room decor. P10 explained, *'This technology would make the hardware less noticeable in my home, reducing the impact of having my office in a living space... the entire workstation could look less techy (i.e., less black + plastic) and more home-like.'* (P10). Additionally, she suggested the *Retractable Office* (Figure 14.B), a design where dining room objects expand when needed and shrink when not in use. Although this technology may seem implausible, P10 aimed to convey her desire for future technologies that could maintain a home-like atmosphere. In a similar vein, P6 introduced the *Flying Monitor* (Figure 14.C) for his master bedroom workspace, which could disappear when not in use. Since he shares the space with his wife after work, he wishes to repurpose the area. While current technology cannot physically manipulate space or alter the scale of tangible objects, there is an opportunity to support less permeable boundaries between work and home by focusing on modifying the aesthetic aspects of work-related objects while preserving their functionality.

Having a partner in a work-from-home setting helps participants feel less isolated and more positive (Section 4.3). However, it also poses challenges in maintaining conversational variety and avoiding monotony when living and working in the same space. P3 expressed the difficulty of coming up with new conversation subjects when they have dinner together: *'it's hard to like come up, especially when you live with that person and you're like in the same house. You experience everything at the same time with the same person'* (P3). To compensate for this, P3 admitted to having the TV on in the background during dinner, which led to less conversation than desired. To address this, we presented P3 with the *Food Anatomy* design (Figure 14.D), aimed at facilitating communication during dinner. Inspired by P3's passion for cooking, it offers food stories and fun facts for engaging mealtime conversations. P3 agreed that such a design might foster more meaningful social interactions during dinner. Similarly, the *Love Mailbox and Messenger* (Figure 3) encourages P2 and her partner to write journal messages to share their everyday experiences. Since P2 and her husband co-founded a company together, they frequently chat about work-related topics during the day. To connect in non-work ways with her husband, P2 keeps a "Q&A journal" notebook, but reported that the journal currently gets little use. The *Love Mailbox and Messenger* adds a playful element to this existing artifact, with a magic pigeon delivering each entry to the recipient's workplace mailbox. P2 reflected, *'[With this technology,] I would read my husband's journal messages from yesterday with breakfast to start the day.... I love the idea of it bringing a reflection we both do separately and then sharing with each other'* (P2). She suggested adding reminders to maintain the habit. Implementing such technologies could help remote workers maintain connections with their partners, addressing one of the key challenges of coexisting work and home life.

6 DISCUSSION

This study addresses the need for understanding how digital technology can support remote/hybrid work while considering the interplay between the activities of remote work and the socio-cultural

aspects of remote workers' homes. Previous studies have found a significant association between office environments and employees' performance, productivity, and well-being (e.g., [26, 33, 86]). With homes increasingly recognized as future workplaces for remote and hybrid work, it is imperative to understand how workers in these modalities engage with their home environments. Cho et al. [20] identified diverse forms of boundary work undertaken by individuals managing multiple roles and practices within a single space, influencing the way they shape their home. Our work complements these findings by examining the sociocultural aspects of how each individual domesticates work into their home. We closely observed how participants (re)gain a sense of home within their unique domestic settings, considering both their professional backgrounds and personal characteristics influenced by social and cultural contexts. This investigation seeks to comprehend the reasons behind their adoption of specific practices, thereby identifying potential design opportunities for technology in their homes as a future workplace. Subsequently, our identification of various senses of place established by participants to shape their remote and hybrid work modalities provides valuable insights for technology design. Building on our understanding of participants' placemaking challenges and strategies reported in Section 4, we engaged in co-speculation regarding their potential interactions with digital technology specifically designed to enhance their experiences. Through a deep understanding of their remote and hybrid work experiences, we presented technological ideas that take into account more holistic perspectives in configuring their work-from-home settings. For example, instead of solely focusing on the challenges participants faced, our discussion explored nuanced and contextually sensible ideas for envisioning technologies. Additionally, participants participated in co-speculative practices, employing designerly ways to comprehend their everyday experiences, facilitated through engagement with cultural probe activities. As a result, we uncovered opportunities for digital technologies to facilitate smoother transitions and redefine boundaries, fostering a harmonious integration of work life and home life. Below, we discuss how these insights can inform the development of future technologies for remote/hybrid work, contributing to more sustainable and successful work arrangements.

6.1 Roles of Digital Technologies in Remote and Hybrid Work

Through discussions and design exchanges with 11 remote workers, we find that digital technology for remote/hybrid work serves two essential roles: *reinforcing* and *reclaiming* the meaning of home, two distinct mechanisms for facilitating the harmonization of work and life activities within the home. These roles acknowledge the diverse and varied nature of home, helping individuals balance their work and personal lives more seamlessly. A summary of these roles can be found in Table 2.

6.1.1 Unremarkable Technologies: Reinforcing the Meaning of Home by Leveraging Existing Practices. Routines provide a sense of normalcy in daily life, enabling efficient task completion and helping to manage uncertainty through repetition [20, 43, 72, 90, 108]. Our research unveiled participants' development of routines and rituals to help them manage multiple roles within constrained physical spaces. In the design concepts, both the research team and our participants leveraged existing routines, demonstrating how technologies can *reinforce* daily work-from-home practices, enhancing productivity and satisfaction across roles. These findings align with the concept of *unremarkable computing* [102], illustrating how technology can seamlessly integrate into daily routines, such as participants' repetitive morning work "start-up" practices.

Our findings suggest that understanding the symbolic meaning of existing routines is a crucial step in seamlessly integrating unremarkable technologies into these routines. Participants established routines by personalizing their home environments to meet their needs and expectations related to their multiple roles, enabling them to navigate home–work boundaries effectively. To reinforce these existing repetitive practices, technologies should emphasize the ritualistic aspects—the underlying meaning of routines and why individuals engage in specific practices [10]—that enable remote workers to express themselves authentically. For example, we found that by considering participants' preferred home activities, technologies could facilitate smooth transitions between home and work (e.g., *Fortune Cookie Cup*, *Food Punch Machine*). Also, to promote a better work–life balance, technologies could help individuals feel productive in their roles as family members or individuals by emphasizing the meaningful aspects of these co-existing roles, including their social relationships with household members (e.g., *Magic House Map*, *Time to Pet Me*). In this way, technology supports not only the achievement of daily task objectives but also provides emotional gratification through these practices.

Our findings emphasize technology's potential roles in reinforcing existing routines, enhancing the efficiency of work and home practices, and strengthening participants' sense of attachment. Participants expressed the need for more effective and functional management of everyday tasks and work, leading to the development of designs that cater to specific pain points (e.g., *Temperature Steady Coffee Cup*) and that help them to fulfill their responsibilities (e.g., *Humming Housewares*). Furthermore, technology has the potential to boost productivity by cultivating an emotional connection to work practices that cater to individuals' unique backgrounds and preferences (e.g., *Neighborhood Periscope*). These designs, though utilitarian, hold value in capturing participants' desire to *streamline* everyday practices influenced by remote work. While this may seem contrary to the original intent of the Bespoke Booklets method [35], our findings highlight the value to participants of such solution-driven technologies. This doesn't suggest that solely focusing on functionality in technology enhances the meaning of home; instead, technology should integrate into remote workers' routines to maintain, refine, or create a sense of normalcy within their unique living spaces.

Our study highlights the importance of designing future technologies with a deep sensitivity to the meaning(s) ascribed to the home and embodied by its inhabitants' everyday practices. Relph argued that a place could lose its meaning if distinctive properties of that place are eradicated, leading to an increasing sense of 'placelessness' [82]. Neglecting to consider remote workers' existing routines or rituals that reflect the socio-cultural aspects of their home arrangements may lead to a one-size-fits-all technology approach, ultimately contributing to the creation of these sorts of

Table 2: Two roles of digital technologies in remote/hybrid work

Roles	Descriptions	Examples	Design Considerations
Reinforcing	Reinforcing the meaning of home by highlighting the symbolic meaning behind existing routines and rituals and supporting the stability of these established practices	• Transitions: *Fortune Cookie Cup* (P3), *Food Punch Machine* (P11), *Magic House Map* (P7), *Time to Pet Me* (P3), *Humming Housewares* (P11) • Work practices: *Neighborhood Periscope* (P10), *Temperature Steady Coffee Cup* (P2)	Unremarkable technologies embracing the meanings and values of established practices
Reclaiming	Reclaiming the meaning of home through the establishment of new ritualistic practices or by encouraging individuals to reassess the significance of particular spaces or temporality within their homes	• Transitions: *Reflection Poster* (P8), *Creative Outlet Crochet* (P11) • Work practices: *Tactile Changing Carpet* (P1) • Original sense of home: *Love Mailbox and Messenger* (P2), *Retractable Office* (P1)	Reflective technologies fostering joyful experiences

placeless [82] home environments. Beyond a superficial comprehension of the repetitive practices employed in remote and hybrid work settings, our work further explored the intricacies of existing routines and rituals, with a focus on their symbolic meanings. By doing so, we could develop concepts of diverse unremarkable technologies tailored to individuals' unique needs and desires, contributing to an enriched meaning of home. We propose that future research could harness the concept of unremarkable technologies to help individuals in creating or maintaining their own sense of place.

6.1.2 Reflective Technologies: Reclaiming Meaning by Leveraging Possessions and Spaces. Our findings also emphasize how technology can help remote workers *reclaim* the meaning of home through reflective practices, thereby facilitating a healthier and potentially more sustainable approach to remote/hybrid work. Both the co-speculative technologies that our research team designed and those proposed by our participants underscore the significance of personal possessions laden with memories and experiences [30] as resources for reclaiming the meaning of home through everyday reflection. Participants are more likely to make sense of their experiences, manage their time, and nurture social relationships when technology is designed around personally meaningful objects that create a strong attachment to the surrounding environment. Leveraging these objects allows participants to create a space where they reconsider how they allocate their time and adopt a more sustainable approach to time management (e.g., *Reflection Poster*, *Creative Outlet Crochet*). Additionally, meaningful objects can facilitate remote workers in re-establishing social interactions within the home (e.g., *Love Mailbox and Messenger*).

Moreover, in remote/hybrid work settings, imagined technologies prompt a reconsideration of conventional perceptions tied to room functions dictated by modern floor plans. The prevailing rational norms ingrained in contemporary housing design often rigidly assign predetermined functions to each space in a home [66]. The widespread adoption of remote work has led to the integration of professional aspects into personal spaces, offering a unique opportunity to challenge and redefine preconceived notions. Our findings demonstrate how technology could help participants reinterpret the meaning of specific spaces by encouraging playful activities (e.g., *Tactile Changing Carpet*) or creatively reshaping their spaces with technology, even in imaginative ways (e.g., *Retractable Office*). Through the use of technologies that aid individuals in reclaiming the meaning of home, there exists a potential for these technologies to contribute to a reevaluation of modernist home design, ultimately helping remote workers refine their spatial use for enhanced productivity and well-being.

Considering the examples previously discussed, participants reported valuing technologies that bring joy to their everyday activities, enabling them to rediscover the meaning of certain spaces and reflect on the balance between work life and personal life. Given the intimate relationship between home and its inhabitants, domestic environments are acknowledged as spaces conducive to daily reflective practices [52, 69]. Our findings supported this perspective, indicating that participants tend to engage in meaning-making within their remote/hybrid work environments through organic and joyful interactions with technology intimately linked to their home's values and essence. The concept of enhancing technology experiences with charm, delight, and playfulness is not new. Wright et al. introduced the notion of *enchantment* to support aesthetic interactions, adopting a holistic approach to understanding user experiences [109]. Gaver also emphasized the ludic aspects of everyday life when designing technology that can support reflection through playful engagement [48]. By highlighting the potential of leveraging personal possessions and spaces to create joyful experiences, we propose that prioritizing interactions that elicit joy in digital technologies can serve as a potent approach to reflective technology in remote/hybrid work settings. This approach can assist remote workers in reclaiming the meaning of home in a healthier manner.

Future research is needed to explore how technology supporting joyful experiences at home can facilitate the inner conversations

essential for effective reflection. According to Mezirow, the pre-reflective stage of awareness is pivotal for realizing meaning and value in a transformative process [65]. While joyful experiences may not be a necessity for deep engagement in the reflective process, technology can play a role in helping remote workers notice new meanings or values in their existing joyful moments at home [21, 34]. Future research can also explore how technology can scaffold everyday reflection in remote work practices, examining ways to assist remote workers in engaging with their joyful moments at home and fostering the pre-reflective stage of awareness.

6.2 Designing an Unplugged Retreat: The Role of Non-technological Elements in Creating a Sense of Home Alongside Remote/Hybrid Work

Our findings also pointed out that not every room in a home should incorporate digital technologies to enhance remote/hybrid work experiences. In the bespoke booklets, both the research team and our participants proposed imagined technologies for various spaces, including dedicated home offices, living rooms, kitchens, and patios. However, some participants explicitly opposed the idea of using technologies in specific places or at certain times. For instance, P10 didn't want to imagine any technologies for her living room, a space she reserved for family and personal relaxation activities like reading or knitting. Similarly, P9 preferred not to have any technologies present during family reading time with her child. These participants deliberately excluded technologies from spaces dedicated to self-care or social interaction.

As digital technologies become integrated into domestic settings, blurring the boundary between work and home, their role in either reinforcing remote workers' practices or reclaiming the meaning of home could have unintended ramifications, especially when deployed in spaces primarily used for personal and social activities. In such cases, designers must exercise caution to avoid encroaching upon or undermining the original sense of the home.

A "digital detox," such as using the ScreenTime functionality of iOS devices to reduce time spent on a mobile device, offers an alternative approach to promote wellbeing without heavy reliance on technology [79]. Designers creating new technologies for remote/hybrid work should also consider the notion of "non-design" [9, 56], respecting people's intimate places and times within their home. This doesn't mean that technologies are inappropriate in supporting self-care or social interaction from home. Rather, we argue that the purpose and meaning of a particular place for remote workers should be considered first when determining the necessity of technology.

6.3 Toward Sustainable Work-From-Home Practices: Embracing the Social Components of Home in 'Future of Work' Narratives

Finally, our findings prompt a reconsideration of the prevailing approach to designing technologies for the so-called 'Future of Work.' Despite ongoing endeavors to design systems and infrastructures that facilitate remote work [27], commercially available technologies predominantly reflect the perspectives of employers and organizations, placing a strong emphasis on enhancing work productivity and fostering work-related collaboration in remote environments. In this section, we discuss the implications of our findings for this narrative and advocate for a broader understanding of remote work infrastructure.

Our findings highlight the importance of social interaction *within* the home, which influences how remote workers negotiate boundaries between work and home to improve their overall productivity and wellbeing. For instance, the existing routines or behaviors of household members can influence how remote workers establish boundaries between their work and personal lives, allowing them to effectively manage their time. Additionally, the dynamics remote workers have with cohabitants can regulate how remote workers allocate specific areas for work or establish designated workspaces that facilitate productivity and concentration. Furthermore, the support and cooperation of household members contribute to fostering a conducive environment for remote workers' overall wellbeing. Recognizing and considering the influence of household members allows remote workers to better manage work–life balance and optimize their work performance at home.

As emphasized by Star and Bowker [95], infrastructures are not standalone entities but are deeply embedded in organizations. Moreover, infrastructure is fundamentally relational, existing as a complex network of interconnections [96]. Thus, our findings raise important questions regarding the scope of social and organizational infrastructure in the context of remote and hybrid work modalities.

Based on our findings, recognizing the influence of social elements stemming from the home environment becomes crucial. We emphasize the significance of household members and their relationships as key entities shaping the social infrastructure of remote work. This perspective expands beyond the traditional organizational viewpoint and underscores the necessity of designing infrastructure that accommodates the unique social dynamics and needs within the home. By acknowledging the centrality of and incorporating the social components of home into the creation of remote work infrastructure, remote and hybrid work can become more flexible, inclusive, and adaptable, fostering work environments that better align with the diverse needs and contexts of the individuals who are given both the privilege and responsibility of juggling these co-existing roles in the home.

6.4 Limitations and Future Work

While our research allowed for in-depth engagement with participants and their remote work experiences, it was limited in its coverage of diverse geographic and cultural groups, thus hindering a systematic comparison across different backgrounds. For instance, due to institutional limitations about how we could (and could not) compensate participants, we needed to constrain our study recruitment to the United States. To address this limitation and capture a broader range of experiences, we intentionally included immigrant and non-U.S. citizen participants currently residing and working in the U.S. While we considered a specific cultural aspect among non-U.S. citizen participants to explore imagined technology ideas (e.g., Ambient Hometown), making a definitive argument based on our data proves challenging. For instance, we identified a strong bond

among family members and its impact on the work in the cases of non-U.S. citizen participants. However, we also observed a notable influence of social interaction on remote work modalities among participants with U.S. citizenship. While we might assume that the dearth of social capital in a foreign country suggests a closer bond than native family members, we cannot confirm whether this is a unique aspect among non-U.S. citizen remote and hybrid workers. Furthermore, in terms of job types, our study identified a trend associated with academia versus industry settings. However, the sample size is not substantial enough to facilitate a systematic comparison that would unveil clear differences. Our work aimed to concentrate on the distinct home arrangements, domestic circumstances, and individual characteristics aligned with social and cultural backgrounds. This approach allowed for a broad exploration of potential technological roles through the design of *bespoke* items. We believe that our work serves as a valuable starting point for discussions on designing technologies from the employee's perspective, taking into account their unique domestic settings. Therefore, we recommend that future research explore opportunities and challenges in designing digital technologies for remote workers, by narrowing down the focus to specific professions, cultural backgrounds, or types of dwellings with a more inclusive perspective on domestic environments [57].

Furthermore, we encountered challenges in fully engaging participants in the designerly process based on our correspondence-based research design, which we developed to engage busy participants at their own pace and in the context of their own home environments. While participants effectively conveyed their envisioned technologies and their integration into their lives through written narratives, they often relied on text alone, omitting sketched illustrations in their bespoke booklets. Sketches are valuable tools for exploring design possibilities, but for novices, it can be difficult to grasp their use in ideating and communicating their concepts and design intentions [107]. To enhance the participatory approach in speculative design, future studies could consider additional activities that help participants feel more at ease in a series of design exercises or compare results obtained through remote correspondence to in-person design workshops.

Lastly, we encourage future research to incorporate a critical perspective when understanding phenomena and designing technology for the futures of remote and hybrid work. Earlier research conducted during the COVID-19 pandemic argued that the pandemic exacerbated the gender gap in household labor, especially when female household members worked from home while their partners did not [37, 81]. Our study further revealed that female participants tend to openly discuss their household labor, using it as a boundary strategy. These findings align with observations made during the early stages of the COVID-19 pandemic, suggesting that these patterns persist beyond the lockdown period and the normalization of childcare systems. While it is crucial to incorporate a critical perspective to challenge societal norms, structures, or power dynamics within domestic settings when envisioning future technologies [8, 11, 84], our study did not critically engage with this aspect. This is because female participants, who frequently utilized household labor as a means of boundary work, reported deriving enjoyment from cooking or feeling productive both as individuals and as household members. It's worth noting that remote work, especially for single parents or women, becomes more critical [37, 59]. To foster more inclusive and adaptable futures for remote and hybrid work, future work can stimulate ideas and explore how digital technologies challenge and address gender inequalities arising from both domestic and organizational settings.

7 CONCLUSION

In this article, we introduced co-speculative technologies designed to engage in continuous and discursive meaning-making within the home. Remote work demands that employees navigate multiple roles and tasks within the same physical space. Our work presented diverse yet mundane modes of working and living among remote workers, contributing to the identification of theoretical ideas on how these individuals shape their sense of place to carry out their remote and hybrid work within domestic settings. Informed by these insights and subsequent discussions with participants, our work envisioned the potential roles of digital technology in enabling the coexistence of work life and home life activities in remote and hybrid settings. Through empirical findings and designerly practices, we revealed how technologies can reinforce existing routines or rituals to support role transitions between work and home. We also found that technologies can reclaim the home by enabling the creation of new rituals and reconsidering the meaning of home. We advocate for technology designers to consider the socio-cultural aspects of the home, which encompass people's thoughts, memories, and desires, in supporting remote workers as they navigate their increasingly intertwined work and personal lives.

ACKNOWLEDGMENTS

We would like to express our gratitude to the Too Much Information Lab at the University of Colorado Boulder and DxD Lab at KAIST, as well as to Laura Devendorf, Clayton Lewis, Bryan Semaan, Christena E. Nippert-Eng, Fuji Robledo Yamamoto, and Samantha Dalal for their support of this project. Additionally, we extend our thanks to the reviewers for their insightful and generative feedback. This work is supported by Beverly Sears Graduate Student Grant from the Graduate School, The Center to Advance Research and Teaching in the Social Sciences Seed Grant, and Student Research Awards from the Institute of Cognitive Science at the University of Colorado Boulder.

REFERENCES

[1] Sherry Boland Ahrentzen. 1990. Managing conflict by managing boundaries: How professional homeworkers cope with multiple roles at home. *Environment and Behavior* 22, 6 (1990), 723–752.

[2] Tammy D Allen, Kelsey Merlo, Roxanne C Lawrence, Jeremiah Slutsky, and Cheryl E Gray. 2021. Boundary management and work-nonwork balance while working from home. *Applied Psychology* 70, 1 (2021), 60–84.

[3] Blake E. Ashforth, Glen E. Kreiner, and Mel Fugate. 2000. All in a day's work: Boundaries and micro role transitions. *Academy of Management Review* 25, 3 (July 2000), 472–491. https://doi.org/10.2307/259305

[4] Mirjam Augstein, Thomas Neumayr, Johannes Schönböck, and Carrie Kovacs. 2023. Remote Persons Are Closer Than They Appear: Home, Team and a Lockdown. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (Hamburg, Germany) *(CHI '23)*. Association for Computing Machinery, New York, NY, USA, Article 615, 25 pages. https://doi.org/10.1145/3544548.3580989

[5] Gaston Bachelard. 2014. *The poetics of space.* Penguin, New York, NY.

[6] Diane E. Bailey and Nancy B. Kurland. 2002. A review of telework research: Findings, new directions, and lessons for the study of modern work. *Journal of*

Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior 23, 4 (2002), 383–400. https://doi.org/10.1002/job.144

[7] Thereza Balliester, Adam Elsheikhi, et al. 2018. The future of work: a literature review. *ILO research department working paper* 29 (2018), 1–62.

[8] Shaowen Bardzell. 2010. Feminist HCI: taking stock and outlining an agenda for design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (Atlanta, Georgia, USA) *(CHI '10)*. Association for Computing Machinery, New York, NY, USA, 1301–1310. https://doi.org/10.1145/1753326.1753521

[9] Eric P.S. Baumer and M. Six Silberman. 2011. When the implication is not to design (technology). In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (Vancouver, BC, Canada) *(CHI '11)*. Association for Computing Machinery, New York, NY, USA, 2271–2274. https://doi.org/10.1145/1978942.1979275

[10] Catherine M Bell et al. 2009. *Ritual: Perspectives and dimensions*. Oxford University Press on Demand, Kettering, Northamptonshire, UK.

[11] Genevieve Bell, Mark Blythe, and Phoebe Sengers. 2005. Making by making strange: Defamiliarization and the design of domestic technologies. *ACM Transactions on Computer-Human Interaction (TOCHI)* 12, 2 (2005), 149–173. https://doi.org/10.1145/1067860.1067862

[12] Nicholas Bloom, Steven J Davis, and Yulia Zhestkova. 2021. Covid-19 shifted patent applications toward technologies that support working from home. In *AEA Papers and Proceedings*, Vol. 111. American Economic Association, American Economic Association 2014 Broadway, Suite 305, Nashville, TN 37203, 263–66.

[13] Alison Blunt. 2005. Cultural geography: cultural geographies of home. *Progress in human geography* 29, 4 (2005), 505–515.

[14] Kirsten Boehner, Janet Vertesi, Phoebe Sengers, and Paul Dourish. 2007. How HCI interprets the probes. 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, 1077–1086. https://doi.org/10.1145/1240624.1240789

[15] Virginia Braun and Victoria Clarke. 2006. Using thematic analysis in psychology. *Qualitative research in psychology* 3, 2 (2006), 77–101.

[16] Thomas Breideband, Robert Glenn Moulder, Gonzalo J Martinez, Megan Caruso, Gloria Mark, Aaron D Striegel, and Sidney D'Mello. 2023. 'Location, Location, Location': An Exploration of Different Workplace Contexts in Remote Teamwork during the COVID-19 Pandemic. *Proceedings of the ACM on Human-Computer Interaction* 7, CSCW1 (2023), 1–22.

[17] Thomas Breideband, Poorna Talkad Sukumar, Gloria Mark, Megan Caruso, Sidney D'Mello, and Aaron Striegel. 2022. Home-Life and Work Rhythm Diversity in Distributed Teamwork: A Study with Information Workers during the COVID-19 Pandemic. *Proceedings of the ACM on Human-Computer Interaction* 6, CSCW1 (2022), 1–23.

[18] Jacob Browne and Laurel Green. 2022. The Future of Work is No Work: A Call to Action for Designers in the Abolition of Work. In *Extended Abstracts of the 2022 CHI Conference on Human Factors in Computing Systems* (New Orleans, LA, USA) *(CHI EA '22)*. Association for Computing Machinery, New York, NY, USA, Article 5, 8 pages. https://doi.org/10.1145/3491101.3516385

[19] Marta E. Cecchinato, Anna L. Cox, and Jon Bird. 2015. Working 9-5?: Professional differences in email and boundary management practices. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI '15)*. ACM Press, New York, NY, 3989–3998. https://doi.org/10.1145/2702123.2702537

[20] Janghee Cho, Samuel Beck, and Stephen Voida. 2022. Topophilia, Placemaking, and Boundary Work: Exploring the Psycho-Social Impact of the COVID-19 Work-From-Home Experience. *Proc. ACM Hum.-Comput. Interact.* 6, GROUP, Article 24 (jan 2022), 33 pages. https://doi.org/10.1145/3492843

[21] Janghee Cho, Laura Devendorf, and Stephen Voida. 2021. From The Art of Reflection to The Art of Noticing: A Shifting View of Self-Tracking Technologies' Role in Supporting Sustainable Food Practices. In *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems* (Yokohama, Japan) *(CHI EA '21)*. Association for Computing Machinery, New York, NY, USA, Article 298, 7 pages. https://doi.org/10.1145/3411763.3451838

[22] Francesco Cirillo. 2018. *The Pomodoro Technique: The acclaimed time-management system that has transformed how we work*. Crown, New York, NY, USA.

[23] Alice Clark. 2013. *The working life of women in the seventeenth century*. Routledge, UK.

[24] Sue Campbell Clark. 2000. Work/family border theory: A new theory of work/family balance. *Human Relations* 53, 6 (2000), 747–770. https://doi.org/10.1177/0018726700536001

[25] Adele E Clarke, Carrie Friese, and Rachel S Washburn. 2017. *Situational analysis: Grounded theory after the interpretive turn*. Sage publications, London, UK.

[26] Susanne Colenberg, Tuuli Jylhä, and Monique Arkesteijn. 2021. The relationship between interior office space and employee health and well-being–a literature review. *Building Research & Information* 49, 3 (2021), 352–366.

[27] CHIWORK Collective, Naveena Karusala, Nabil Al Nahin Ch, Diana Tosca, Alberta A Ansah, Emeline Brulé, Nadia Fereydooni, Le-En Huang, Azra Ismail, Pranjal Jain, Yi Xuan Khoo, Isabel Muñoz, Clemens Schartmüller, Himanshu Verma, Preeti Vyas, Susanne CJ Boll, Sarah E Fox, Noopur Raval, Max L Wilson, Anna L Cox, Christian P Janssen, Helena M Mentis, Neha Kumar, Orit Shaer, and Andrew L Kun. 2022. Human-Computer Interaction and the Future of Work. In *Extended Abstracts of the 2022 CHI Conference on Human Factors in Computing Systems* (New Orleans, LA, USA) *(CHI EA '22)*. Association for Computing Machinery, New York, NY, USA, Article 162, 3 pages. https://doi.org/10.1145/3491101.3516407

[28] McKinsey & Company. 2023. What is the future of work? https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-the-future-of-work

[29] Tim Cresswell. 2013. *Geographic thought: a critical introduction*. Vol. 8. John Wiley & Sons, New Jersey, USA.

[30] Mihaly Csikszentmihalyi and Eugene Rochberg-Halton. 1981. *The meaning of things: Domestic symbols and the self*. Cambridge University Press, Cambridge, UK.

[31] Maitraye Das, John Tang, Kathryn E. Ringland, and Anne Marie Piper. 2021. Towards accessible remote work: Understanding work-from-home practices of neurodivergent professionals. *Proceedings of the ACM on Human-Computer Interaction (PACM-HCI)* 5, CSCW1, Article 183 (April 2021), 30 pages. https://doi.org/10.1145/3449282

[32] Vedant Das Swain, Shane Williams, Adam Fourney, and Shamsi T. Iqbal. 2022. Two Birds with One Phone: The Role of Mobile Use in the Daily Practices of Remote Information Work. In *Proceedings of the 1st Annual Meeting of the Symposium on Human-Computer Interaction for Work* (Durham, NH, USA) *(CHIWORK '22)*. Association for Computing Machinery, New York, NY, USA, Article 2, 8 pages. https://doi.org/10.1145/3533406.3533416

[33] Matthew C Davis, Desmond J Leach, and Chris W Clegg. 2011. The physical environment of the office: Contemporary and emerging issues. *International Review of industrial and organizational psychology 2011* 26 (2011), 193–237.

[34] Audrey Desjardins, Heidi R. Biggs, Cayla Key, and Jeremy E. Viny. 2020. IoT Data in the Home: Observing Entanglements and Drawing New Encounters. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (Honolulu, HI, USA) *(CHI '20)*. Association for Computing Machinery, New York, NY, USA, 1–13. https://doi.org/10.1145/3313831.3376342

[35] Audrey Desjardins, Cayla Key, Heidi R. Biggs, and Kelsey Aschenbeck. 2019. Bespoke Booklets: A Method for Situated Co-Speculation. In *Proceedings of the 2019 on Designing Interactive Systems Conference* (San Diego, CA, USA) *(DIS '19)*. Association for Computing Machinery, New York, NY, USA, 697–709. https://doi.org/10.1145/3322276.3322311

[36] Paul Dourish and Genevieve Bell. 2014. "Resistance is futile": reading science fiction alongside ubiquitous computing. *Personal and ubiquitous computing* 18, 4 (2014), 769–778.

[37] Allison Dunatchik, Kathleen Gerson, Jennifer Glass, Jerry A Jacobs, and Haley Stritzel. 2021. Gender, parenting, and the rise of remote work during the pandemic: Implications for domestic inequality in the United States. *Gender & Society* 35, 2 (2021), 194–205.

[38] Hazel Easthope. 2004. A place called home. *Housing, theory and society* 21, 3 (2004), 128–138.

[39] Noella Edelmann, Judith Schossboeck, and Valerie Albrecht. 2021. Remote Work in Public Sector Organisations: Employees' Experiences in a Pandemic Context. In *DG.O2021: The 22nd Annual International Conference on Digital Government Research* (Omaha, NE, USA) *(DG.O'21)*. Association for Computing Machinery, New York, NY, USA, 408–415. https://doi.org/10.1145/3463677.3463725

[40] Jeffrey R Edwards and Nancy P Rothbard. 2000. Mechanisms linking work and family: Clarifying the relationship between work and family constructs. *Academy of management review* 25, 1 (2000), 178–199.

[41] Nicole B. Ellison. 1999. Social impacts: New perspectives on telework. *Social Science Computer Review* 17, 3 (1999), 338–356. https://doi.org/10.1177/089443939901700308

[42] Anja Endmann and Daniela Keßner. 2016. User Journey Mapping–A Method in User Experience Design. *i-com* 15, 1 (2016), 105–110.

[43] Barbara H Fiese, Thomas J Tomcho, Michael Douglas, Kimberly Josephs, Scott Poltrock, and Tim Baker. 2002. A review of 50 years of research on naturally occurring family routines and rituals: Cause for celebration? *Journal of family psychology* 16, 4 (2002), 381.

[44] Rowanne Fleck, Anna L. Cox, and Rosalyn A.V. Robison. 2015. Balancing boundaries: Using multiple devices to manage work-life balance. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI '15)*. ACM Press, New York, NY, 3985–3988. https://doi.org/10.1145/2702123.2702386

[45] Kathryn L. Fonner and Lara C. Stache. 2012. All in a day's work, at home: Teleworkers' management of micro role transitions and the work–home boundary. *New Technology, Work and Employment* 27, 3 (2012), 242–257. https://doi.org/10.1111/j.1468-005X.2012.00290.x

[46] Denae Ford, Margaret-Anne Storey, Thomas Zimmermann, Christian Bird, Sonia Jaffe, Chandra Maddila, Jenna L Butler, Brian Houck, and Nachiappan Nagappan. 2021. A tale of two cities: Software developers working from home during the covid-19 pandemic. *ACM Transactions on Software Engineering and Methodology*

(TOSEM) 31, 2 (2021), 1–37.
[47] Bill Gaver, Tony Dunne, and Elena Pacenti. 1999. Design: cultural probes. *interactions* 6, 1 (1999), 21–29. https://doi.org/10.1145/291224.291235
[48] William Gaver. 2001. Designing for ludic aspects of everyday life. *Ercim News* 47 (2001), 20–21.
[49] Sean Rintel Gloria Mark, Andrew L. Kun and Abigail Sellen. 2022. Introduction to this special issue: the future of remote work: responses to the pandemic. *Human–Computer Interaction* 37, 5 (2022), 397–403. https://doi.org/10.1080/07370024.2022.2038170 arXiv:https://doi.org/10.1080/07370024.2022.2038170
[50] Jeffrey H Greenhaus, Karen M Collins, and Jason D Shaw. 2003. The relation between work–family balance and quality of life. *Journal of vocational behavior* 63, 3 (2003), 510–531.
[51] Laurence Habib and Tony Cornford. 1996. The virtual office and family life. In *Proceedings of the 1996 ACM SIGCPR/SIGMIS Conference on Computer Personnel Research* (Denver, Colorado, USA) *(SIGCPR '96)*. Association for Computing Machinery, New York, NY, USA, 296–304. https://doi.org/10.1145/238857.238911
[52] Lars Hallnäs and Johan Redström. 2001. Slow technology–designing for reflection. *Personal and ubiquitous computing* 5, 3 (2001), 201–212.
[53] Susan Hanson and Geraldine Pratt. 1988. Reconceptualizing the links between home and work in urban geography. *Economic geography* 64, 4 (Oct. 1988), 299–321. https://doi.org/10.2307/144230
[54] Steve Harrison and Paul Dourish. 1996. Re-place-ing space: the roles of place and space in collaborative systems. In *Proceedings of the 1996 ACM Conference on Computer Supported Cooperative Work* (Boston, Massachusetts, USA) *(CSCW '96)*. Association for Computing Machinery, New York, NY, USA, 67–76. https://doi.org/10.1145/240080.240193
[55] E. Jeffrey Hill, Alan J. Hawkins, and Brent C. Miller. 1996. Work and family in the virtual office: Perceived influences of mobile telework. *Family Relations* 49, 3 (July 1996), 293–301. https://doi.org/10.2307/585501
[56] Sarah Homewood. 2019. Inaction as a Design Decision: Reflections on Not Designing Self-Tracking Tools for Menopause. In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems* (Glasgow, Scotland Uk) *(CHI EA '19)*. Association for Computing Machinery, New York, NY, USA, 1–12. https://doi.org/10.1145/3290607.3310430
[57] Asiya Islam. 2022. Work-from/at/for-home: CoVID-19 and the future of work–A critical review. *Geoforum* 128 (2022), 33–36.
[58] Ryan M. Kelly, Yueyang Cheng, Dana McKay, Greg Wadley, and George Buchanan. 2021. "It's About Missing Much More Than the People": How Students Use Digital Technologies to Alleviate Homesickness. 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 226, 17 pages. https://doi.org/10.1145/3411764.3445362
[59] Olga Khazan. 2023. One Big Benefit of Remote Work: It's helped bring mothers back to the workforce. https://www.theatlantic.com/ideas/archive/2023/09/women-remote-work-shecession-employment-rate/675488/ Accessed on November 24, 2023.
[60] U.S. DEPARTMENT OF LABOR. 1992. Definition of "Work" for Purposes of Section 3304(a)(7) of the Federal Unemployment Tax Act. https://oui.doleta.gov/dmstree/uipl/uipl92/uipl_1892.htm#:~:text=In%20accordance%20with%20the%20language,for%20which%20remuneration%20is%20payable. Accessed on November 21, 2023.
[61] Gloria Mark. 2015. Multitasking in the digital age. *Synthesis Lectures on Human-Centered Informatics* 8, 3 (2015), 1–113.
[62] Melissa A. Mazmanian, Wanda J. Orlikowski, and JoAnne Yates. 2005. Crackberries: The social implications of ubiquitous wireless e-mail devices. In *Designing Ubiquitous Information Environments: Socio-Technical Issues and Challenges (Proceedings of the IFIP TC8 WG 8.2 International Working Conference)*. Springer, Boston, MA, 337–343. https://doi.org/10.1007/0-387-28918-6_25
[63] Joshua McVeigh-Schultz and Katherine Isbister. 2022. A "beyond being there" for VR meetings: envisioning the future of remote work. *Human–Computer Interaction* 37, 5 (2022), 433–453.
[64] Jon C Messenger and Lutz Gschwind. 2016. Three generations of Telework: New ICT s and the (R) evolution from Home Office to Virtual Office. *New Technology, Work and Employment* 31, 3 (2016), 195–208.
[65] Jack Mezirow. 1991. *Transformative dimensions of adult learning*. ERIC.
[66] Nusrat Jahan Mim, Dipannita Nandi, Sadaf Sumyia Khan, and Arundhuti Dey. 2022. F-commerce and Urban Modernities: The Changing Terrain of Housing Design in Bangladesh. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems* (New Orleans, LA, USA) *(CHI '22)*. Association for Computing Machinery, New York, NY, USA, Article 238, 20 pages. https://doi.org/10.1145/3491102.3502071
[67] Kiran Mirchandani. 1998. Protecting the boundary: Teleworker insights on the expansive concept of "work". *Gender & Society* 12, 2 (1998), 168–187.
[68] Ine Mols, Elise van den Hoven, and Berry Eggen. 2016. Technologies for Everyday Life Reflection: Illustrating a Design Space. In *Proceedings of the TEI '16: Tenth International Conference on Tangible, Embedded, and Embodied Interaction* (Eindhoven, Netherlands) *(TEI '16)*. Association for Computing Machinery, New York, NY, USA, 53–61. https://doi.org/10.1145/2839462.2839466
[69] Ine Mols, Elise van den Hoven, and Berry Eggen. 2020. Everyday Life Reflection: Exploring Media Interaction with Balance, Cogito & Dott. In *Proceedings of the Fourteenth International Conference on Tangible, Embedded, and Embodied Interaction* (Sydney NSW, Australia) *(TEI '20)*. Association for Computing Machinery, New York, NY, USA, 67–79. https://doi.org/10.1145/3374920.3374928
[70] Joseph W Newbold, Anna Rudnicka, David Cook, Marta E Cecchinato, Sandy JJ Gould, and Anna L Cox. 2022. The new normals of work: a framework for understanding responses to disruptions created by new futures of work. *Human–Computer Interaction* 37, 6 (2022), 1–24.
[71] Peggy ML Ng, Kam Kong Lit, and Cherry TY Cheung. 2022. Remote work as a new normal? The technology-organization-environment (TOE) context. *Technology in Society* 70 (2022), 102022.
[72] Christena E. Nippert-Eng. 2008. *Home and work: Negotiating boundaries through everyday life*. University of Chicago Press, Chicago, IL.
[73] Oladele A. Ogunseitan. 2005. Topophilia and the quality of life. *Environmental Health Perspectives* 113, 2 (2005), 143–148. https://doi.org/10.1289/ehp.7467
[74] International Labour Organization. 2019. Work and employment are not synonyms. https://ilostat.ilo.org/work-and-employment-are-not-synonyms/ Accessed on November 21, 2023.
[75] Adam Ozimek. 2020. The future of remote work. *Available at SSRN 3638597* (2020).
[76] Daniela Petrelli and Ann Light. 2014. Family rituals and the potential for interaction design: a study of Christmas. *ACM Transactions on Computer-Human Interaction (TOCHI)* 21, 3 (2014), 1–29.
[77] Sarah Pink, Kerstin Leder Mackley, Roxana Morosanu, Val Mitchell, and Tracy Bhamra. 2017. *Making homes: Ethnography and design*. Routledge, London, UK.
[78] Joanne H Pratt. 1984. Home teleworking: A study of its pioneers. *Technological forecasting and social change* 25, 1 (1984), 1–14.
[79] Theda Radtke, Theresa Apel, Konstantin Schenkel, Jan Keller, and Eike von Lindern. 2022. Digital detox: An effective solution in the smartphone era? A systematic literature review. *Mobile Media & Communication* 10, 2 (2022), 190–215.
[80] Stuart Reeves. 2012. Envisioning ubiquitous computing. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (Austin, Texas, USA) *(CHI '12)*. Association for Computing Machinery, New York, NY, USA, 1573–1582. https://doi.org/10.1145/2207676.2208278
[81] Malte Reichelt, Kinga Makovi, and Anahit Sargsyan. 2021. The impact of COVID-19 on gender inequality in the labor market and gender-role attitudes. *European Societies* 23, sup1 (2021), S228–S245.
[82] Edward Relph. 1976. *Place and placelessness*. Vol. 67. Pion London, London, UK.
[83] Sanjay Rishi, Benjamin Breslau, and Peter Miscovich. 2021. *The Workplace You Need Now: Shaping Spaces for the Future of Work*. John Wiley & Sons, Chichester, UK.
[84] Gillian Rose. 1993. *Feminism & geography: The limits of geographical knowledge*. U of Minnesota Press.
[85] Anna Rudnicka, Dave Cook, Marta E. Cecchinato, Sandy J. J. Gould, Joseph W. Newbold, and Anna L. Cox. 2022. The end of the active work break? Remote work, sedentariness and the role of technology in creating active break-taking norms. In *Proceedings of the 1st Annual Meeting of the Symposium on Human-Computer Interaction for Work* (Durham, NH, USA) *(CHIWORK '22)*. Association for Computing Machinery, New York, NY, USA, Article 1, 13 pages. https://doi.org/10.1145/3533406.3533409
[86] Abdul-Manan Sadick and Imriyas Kamardeen. 2020. Enhancing employees' performance and well-being with nature exposure embedded office workplace design. *Journal of Building Engineering* 32 (2020), 101789.
[87] Christine Salazar. 2001. Building boundaries and negotiating work at home. In *Proceedings of the 2001 International ACM SIGGROUP Conference on Supporting Group Work* (Boulder, Colorado) *(GROUP '01)*. ACM Press, New York, NY, 162–170. https://doi.org/10.1145/500286.500311
[88] Johnny Saldaña. 2015. *The coding manual for qualitative researchers* (3rd ed.). SAGE Publications, Los Angeles, CA.
[89] Jose Ramon Saura, Domingo Ribeiro-Soriano, and Pablo Zegarra Saldaña. 2022. Exploring the challenges of remote work on Twitter users' sentiments: From digital technology development to a post-pandemic era. *Journal of Business Research* 142 (2022), 242–254.
[90] Bryan Semaan. 2019. 'Routine Infrastructuring'as' Building Everyday Resilience with Technology' When Disruption Becomes Ordinary. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (2019), 1–24.
[91] Phoebe Sengers, Kirsten Boehner, Shay David, and Joseph 'Jofish' Kaye. 2005. Reflective design. In *Proceedings of the 4th Decennial Conference on Critical Computing*. ACM, New York, 49–58. https://doi.org/10.1145/1094562.1094569
[92] Michelle Shumate and Janet Fulk. 2004. Boundaries and role conflict when work and family are colocated: A communication network and symbolic interaction approach. *Human Relations* 57, 1 (2004), 55–74.
[93] Peter Somerville. 1997. The social construction of home. *Journal of architectural and planning research* 14, 3 (1997), 226–245.
[94] Graham L Staines. 1980. Spillover versus compensation: A review of the literature on the relationship between work and nonwork. *Human relations* 33, 2

(1980), 111–129. https://doi.org/10.1177/001872678003300203

[95] Susan Leigh Star and Geoffrey C Bowker. 2006. How to infrastructure. *Handbook of new media: Social shaping and social consequences of ICTs* (2006), 230–245.

[96] Susan Leigh Star and Karen Ruhleder. 1994. Steps towards an ecology of infrastructure: complex problems in design and access for large-scale collaborative systems. In *Proceedings of the 1994 ACM Conference on Computer Supported Cooperative Work* (Chapel Hill, North Carolina, USA) *(CSCW '94)*. Association for Computing Machinery, New York, NY, USA, 253–264. https://doi.org/10.1145/192844.193021

[97] John Tang. 2021. Understanding the telework experience of people with disabilities. *Proceedings of the ACM on Human-Computer Interaction (PACM-HCI)* 5, CSCW1, Article 30 (April 2021), 27 pages. https://doi.org/10.1145/3449104

[98] Qiao Tang, Xinmu Hu, Ziwen Zeng, and Yufeng Zhao. 2022. Co-Orb: Fostering Remote Workplace Gratitude with IoT Technology. In *Extended Abstracts of the 2022 CHI Conference on Human Factors in Computing Systems* (New Orleans, LA, USA) *(CHI EA '22)*. Association for Computing Machinery, New York, NY, USA, Article 488, 6 pages. https://doi.org/10.1145/3491101.3514488

[99] Jaime Teevan, Nancy Baym, Jenna Butler, Brent Hecht, Sonia Jaffe, Kate Nowak, Abigail Sellen, Longqi Yang, Marcus Ash, Kagonya Awori, Mia Bruch, Piali Choudhury, Adam Coleman, Scott Counts, Shiraz Cupala, Mary Czerwinski, Ed Doran, Elizabeth Fetterolf, Mar Gonzalez Franco, Kunal Gupta, Aaron L Halfaker, Constance Hadley, Brian Houck, Kori Inkpen, Shamsi Iqbal, Eric Knudsen, Stacey Levine, Siân Lindley, Jennifer Neville, Jacki O'Neill, Rick Pollak, Victor Poznanski, Sean Rintel, Neha Parikh Shah, Siddharth Suri, Adam D. Troy, and Mengting Wan. 2022. *Microsoft New Future of Work Report 2022*. Technical Report MSR-TR-2022-3. Microsoft. https://www.microsoft.com/en-us/research/publication/microsoft-new-future-of-work-report-2022/

[100] Jaime Teevan, Brent Hecht, and Sonia Jaffe. 2021. The new future of work: Research from Microsoft on the impact of the pandemic on work practices. *Haettu* 7 (2021), 2021.

[101] Leslie Thomson. 2013. "When i've packed it in and they send me something…": Information boundaries in professional home offices. *Proceedings of the American Society for Information Science and Technology* 50, 1 (2013), 1–5. https://doi.org/10.1002/meet.14505001158

[102] Peter Tolmie, James Pycock, Tim Diggins, Allan MacLean, and Alain Karsenty. 2002. Unremarkable computing. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (Minneapolis, Minnesota, USA) *(CHI '02)*. Association for Computing Machinery, New York, NY, USA, 399–406. https://doi.org/10.1145/503376.503448

[103] Yi-Fu Tuan. 1976. Humanistic geography. *Annals of the Association of American Geographers* 66, 2 (1976), 266–276. https://doi.org/10.1111/j.1467-8306.1976.tb01089.x

[104] Yi-Fu Tuan. 1977. *Space and place: The perspective of experience*. U of Minnesota Press.

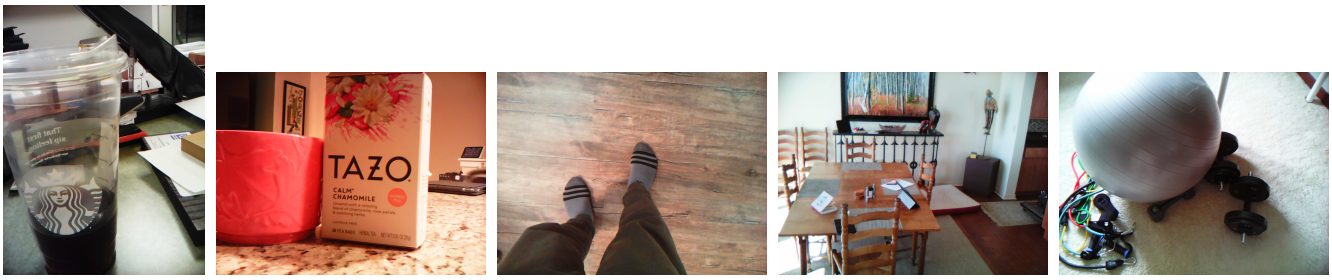
[105] Yi-Fu Tuan. 1990. *Topophilia: A study of environmental perceptions, attitudes, and values*. Columbia University Press, New York, NY.

[106] Max Van Manen. 2016. *Researching lived experience: Human science for an action sensitive pedagogy*. Routledge.

[107] Malcolm Welch, David Barlex, and Hee Sook Lim. 2000. Sketching: Friend or foe to the novice designer? *International Journal of Technology and Design Education* 10 (2000), 125–148.

[108] Jong-bum Woo and Youn-kyung Lim. 2020. Routinoscope: Collaborative routine reflection for routine-driven do-it-yourself smart homes. *International Journal of Design* 14, 3 (2020), 19.

[109] Peter Wright, Jayne Wallace, and John McCarthy. 2008. Aesthetics and experience-centered design. *ACM Transactions on Computer-Human Interaction (TOCHI)* 15, 4 (2008), 1–21.

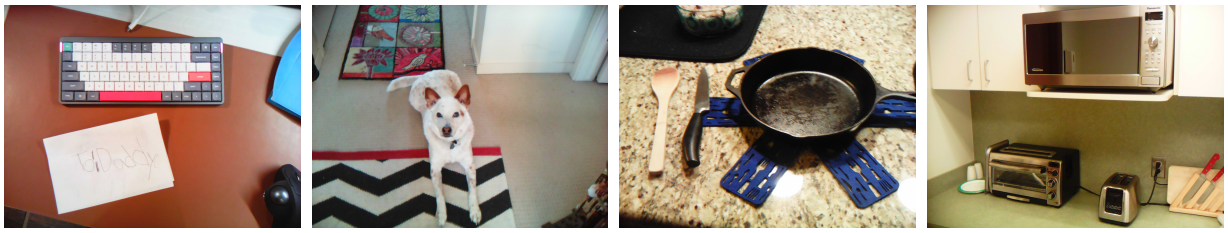


(a) (b) (c) (d) (e)

Figure 4: Various routines/rituals for establishing boundaries: (a) A cup of coffee on P4's work desk: P4 starts his day with coffee, which enhances productivity in both his professional and personal life as a family member; (b) Morning tea in the P3's kitchen: P3 emphasized the importance of having morning tea, stating, *'I have to have my tea in the morning, like if I don't have my tea, it's like I'm not doing work that morning. That's like a ritual for me'* (P3); (c) P7 found the sound of footsteps upstairs in the morning, signifying their family members' bustling activities as they prepared for the day, creating a vibrant and energetic ambiance; (d) P2's dining room: P2 checked emails during breakfast to smoothly transition into her home office work; (e) Exercise equipment beside P9's desk: P9 made exercise a routine part of her workday. She kept exercise equipment beside her desk, enabling her to engage in short workout sessions between meetings.

(a) (b) (c) (d) (e)

Figure 5: Cultivating affective attachment to a home office through diverse strategies (a) P9's home office: P9 carefully curated her home workroom by acquiring suitable equipment, aiming to establish an ideal remote work environment. As a personal touch, she added a LEGO Batwing figure to infuse a sense of individuality; (b) P2's home office: To foster a comfortable and familiar atmosphere, P2 embellished her workspace with personal photos, posters, and decorations; (c) P7's home office: P7 arranged essential work equipment and painted the walls with a preferred color to create a personally appealing environment, creating a pleasant and positive ambiance; (d) Guitars in P8's home office: P8 keeps guitars near his home workstation, providing personal relaxation during the day; (e) A window view from P9's home office: One element that contributes to P9's personal productivity is the magnificent view of Mt [Name] from their home office. This scenic vista enhanced her sense of accomplishment and motivation.



(a) (b) (c) (d)

Figure 6: Establishing boundaries through social interactions from home: (a) A handwritten letter from P7's daughter: Towards the end of the day, P7 experienced the presence of his family members, especially when his kids return home from school. On one occasion, his daughter dropped a card as she entered the house. P7 said *'You flip your brain around, because the kids will be home, my wife will be home…And it kind of gets me into this mode of like "okay, I'm done with work now I can focus on my family or I can focus on something that I need that I'm supposed to be doing." So within that, you're going out to the grocery store or doing some yard work'* (P7); (b) P2's dog: As the day draws to a close, P2's dog approached her, expressing excitement through sounds, indicating its desire for a walk; (c) Kitchenware in P3's kitchen: For P3, the use of cooking equipment served not only to enhance her productivity as a household member but also brought her joy when preparing meals that her partner enjoys. This became an effective strategy for P3 to transition away from work; (d) Kitchen from P4's house: P4 often smells dinner being cooked and hears their spouse preparing it, marking the end of their workday.

(a) (b) (c)

Figure 7: Having a flexible schedule and break during a day: (a) Balls playing with P6's kids: P6 enjoys a more permeable boundary between work and home, allowing for extended time with their children. Thanks to the flexibility of his work, he allocated additional time in the evenings when his children were going to bed; (b) Kitchen from P9's house: During short breaks, P9 efficiently utilizes their time by engaging in household chores, such as loading the dishwasher; (c) P2's family photo: P2 values the opportunity to chat with her partner during breaks, likening it to water cooler conversations: *'In some ways, you know I see him [P2's partner], I have somebody to talk, like in between calls, like the water cooler talk, right?'* (P2).

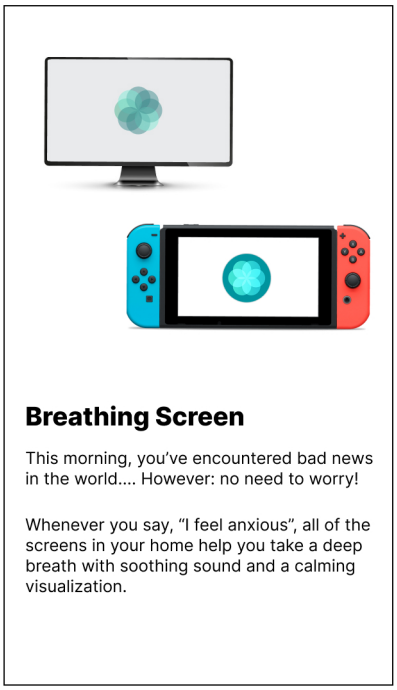
(a) (b) (c) (d) (e)

Figure 8: Strategies for using non-work spaces for remote/hybrid work: (a) & (b) P10's Dining Room Workspace: P10 acquired a wheeled desk to adapt her dining room for work, offering concentration and privacy. However, she wasn't satisfied with the room's aesthetics and furniture arrangement; (c) P1's Dining Room Workspace: P1 dubbed her dining room table the 'magic table' for its productivity. However, her housemate felt uncomfortable using the dining area for meals when P1 was working, leading to occasional work interruptions; (d) P6's Bedroom Workspace: P6 sets up his workstation in the master bedroom, specifically in front of the master bed; (e) P5's Living Room: Due to the absence of a dedicated workspace, P5 shared a communal desk with housemates, including their best friend and roommate. Both worked as remote customer service representatives for the same company, often choosing to work together in the living room. This collaborative setup allowed them to support each other, seeking advice or consensus when facing difficult conversations or decision-making tasks by placing their laptops side by side.

Fragrant Fabric

Even though you drank tea with your son before he headed off to preschool on the first floor, your clothing remembers the scent of the tea. Fragrant Fabric allows you to continue having this shared tea experience as you begin to work in your home office by giving off the smell of the tea that you had together earlier that day.

(A) P9 - Fragrant Fabric

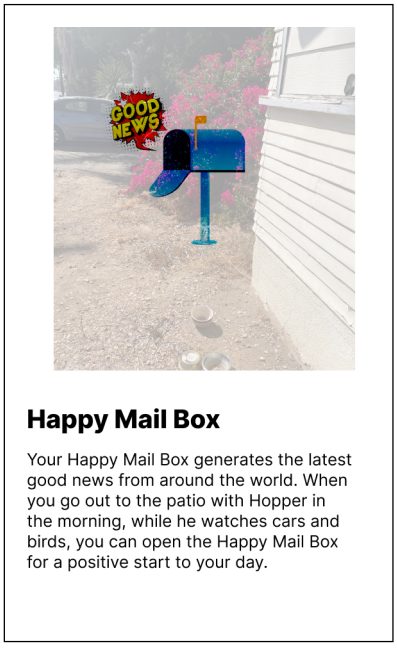


Breathing Screen

This morning, you've encountered bad news in the world.... However: no need to worry!

Whenever you say, "I feel anxious", all of the screens in your home help you take a deep breath with soothing sound and a calming visualization.

(B) P5 - Breathing Screen



Happy Mail Box

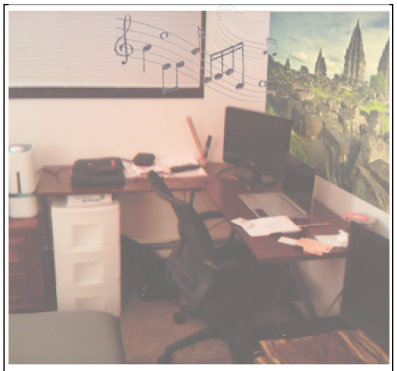
Your Happy Mail Box generates the latest good news from around the world. When you go out to the patio with Hopper in the morning, while he watches cars and birds, you can open the Happy Mail Box for a positive start to your day.

(C) P5 - Happy Mail Box

The Morning Capsule

The Morning Capsule captures a bird song in the morning. You wake up late, and miss your neighbor's morning song? With the Morning Capsule, you can enjoy a calm and peaceful morning.

(D) P1 - The Morning Capsule



Ambient Hometown

It's a rainy day. As starting your work from your bedroom, you can hear the sound of rain. The Ambient Hometown augments natural sounds as if you were in your home country. It also projects your hometown's photo as a background. The photo becomes more vivid as long as you finish your task.

(E) P6 - Ambient Hometown

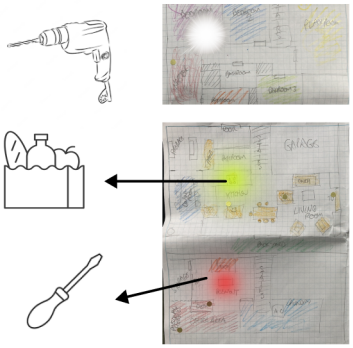
Figure 9: Technologies for start-up routines

Chameleon Photo Frame

Good job! You've been through a lot today. Time to rest and get back to your family.

The Chameleon Photo Frame changes your family photos gradually when you are almost done with your work, slowly drawing your attention to your family role. It also detects your kids footsteps from upstairs and updates its contents more rapidly when it detects that sound.

(A) P7 - Chameleon Photo Frame



Magic House Map

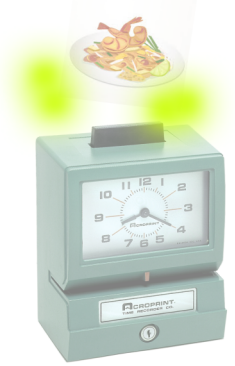
The Magic House Map appears when you are almost done with your work. The map shows what kind of housework needs to be done soon, helping you to transition into and plan for your home-oriented roles. The map consists of not only your home but also your neighborhood, so you can see all the potential tasks that you might undertake to support your family (e.g., shopping, cleaning, cooking). Each time you choose a task, the map visualizes the tool you need for it.

(B) P7 - Magic House Map

Time to Pet Me

Time to stop working! Your dog asks you to go out to walk. The Time to Pet Me interprets what your dog intends to say and shows these interpretations in a message cloud above your dog's head.

(C) P3 - Time to Pet Me



Food Punch Machine

When you punch out for your day, the Food Punch Machine is waiting for you. You can punch it whenever you are ready to make a dish! Then, it shows a dish that people enjoy the most from a certain city or country. You can always set and change a location.

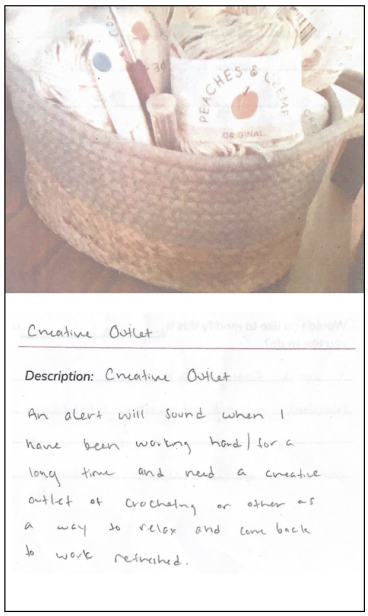
(D) P11 - Food Punch Machine

Grumpy Hard Drive

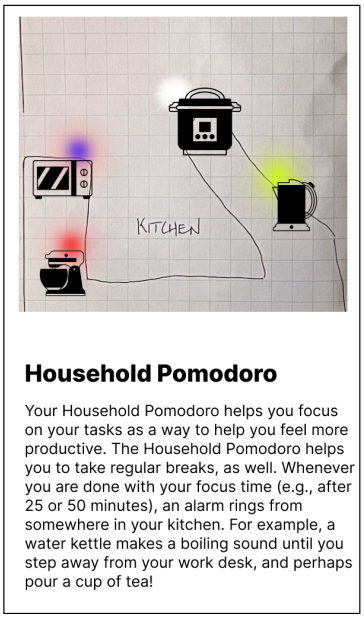
A new project has captured your interest, and as a result, it sometimes feels difficult to pull yourself away from your work. But working long hours is tiring! Also: you are not the only one who is tired at the end of long work days. The Grumpy Hard Drive in your computer whirs and grumbles louder and lounder when you work more than you planned....

(E) P10 - Grumpy Hard Drive

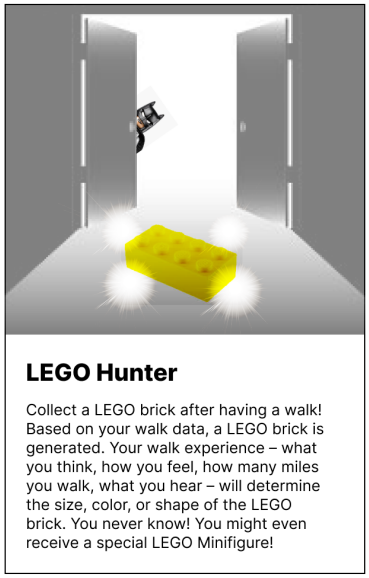
Figure 10: Technologies for shut-down routines



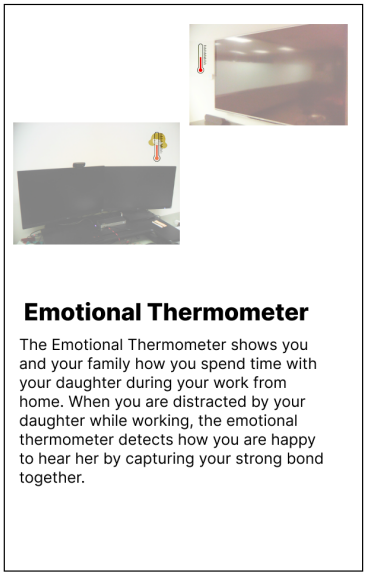
(A) P11 - Creative Outlet Crochet



(B) P10 - Household Pomodoro

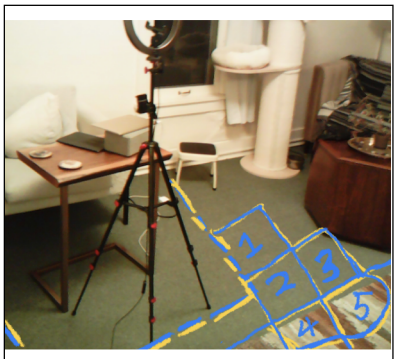


(C) P9 - LEGO Hunter



(D) P4 - Emotional Thermometer

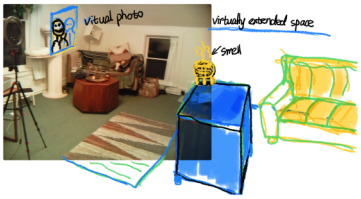
Figure 11: Technologies for Porous boundary



The Magical Hopscotch

The Magic Hopscotch provides a virtual grid on the floor that connects the living room and your two bedrooms. These grids change color and distance, responding to your emotion. When you desire to have a cozy and quiet space, the grid makes it easy to get access to the couch.

(A) P1 - The Magical Hopscotch



Elastic Living Room

The Elastic Living Room makes you more comfortable staying in the living room. Besides your bedroom, you may want to use the other cozy space... The Elastic Living Room invites you into this more spacious and quiet environment, even though your living room is closer to your housemate's space. It will display photos of you and your family on the wall when you are alone in the space, virtually extend itself to give you a sense of spaciousness, and emit the odors that you find pleasant and relaxing.

(B) P1 - Elastic Living Room

Description:
Tactile-changing carpet
The carpet in the living room can change the softness of the touch.
Sometimes you can feel it sandy, others it feels like porcelain, others soft like fur, etc. depending on the user's choice for the moment.

(C) P1 - Tactile-Changing Carpet

Description: A Hybrid AR - real pots garden. There would be a mix of real & AR plants on my patio to make it feel more like a nature space. The real plants would be herbs that are planted in "smart" pots that keep the plant alive. The AR plants I could change depending on my mood.

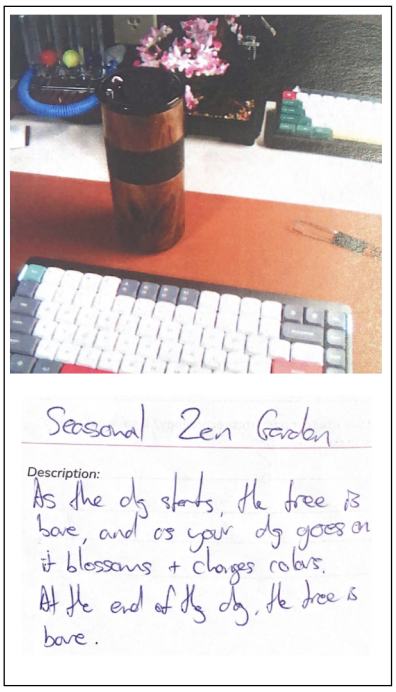
(D) P3 - A Hybrid AR

Togetherness

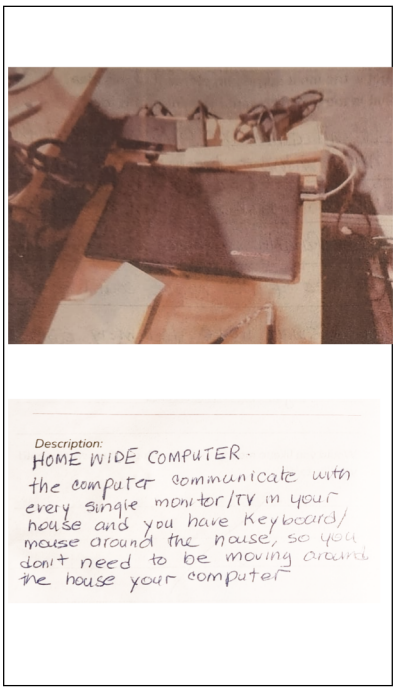
The cover of the colorful laptop luminesces different colors depending on the contents of a conversation with customers—for example, red when you are dealing with an annoying customer. As a result, each household member will be able to recognize when you are are naviagting a tricky issue or whether you might have a good conversation to celebrate. This technology allows everyone in the house to offer help or ask to share moments related to a good working mood.

(E) P5 - Togetherness

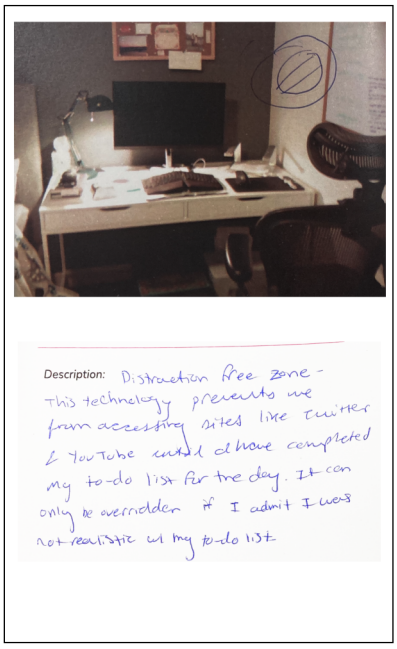
Figure 12: Technologies for reclaiming the meaning of specific spaces



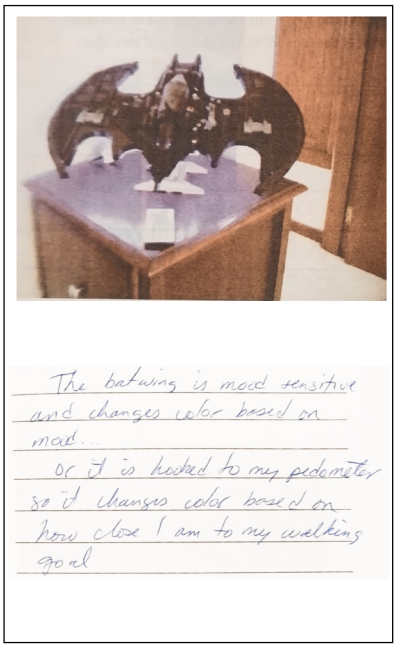
(A) P7 - Seasonal Zen Garden



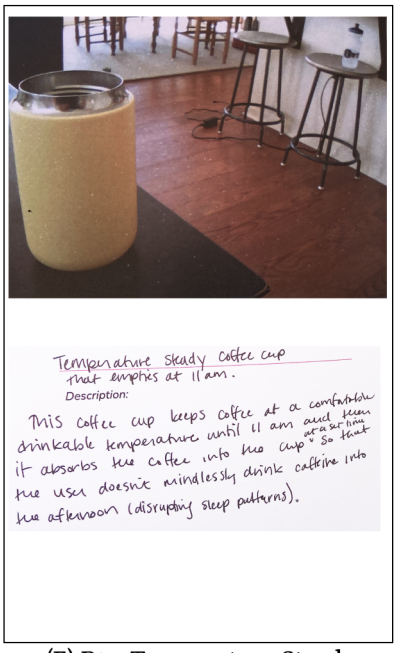
(B) P8 - Home Wide Computer



(C) P3 - Distraction Free Zone

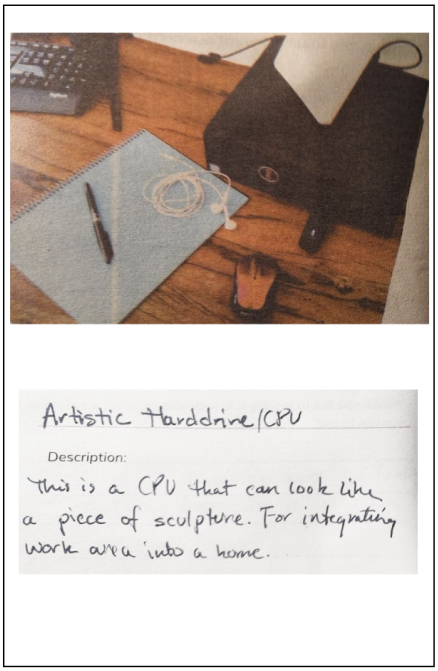


(D) P9 - Batwing

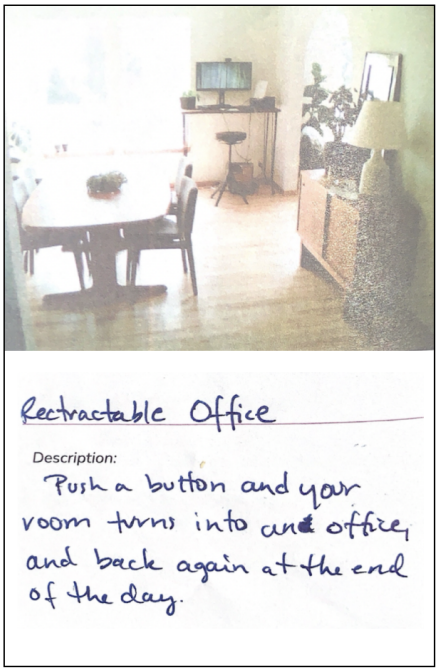


(E) P2 - Temperature Steady Coffee Cup

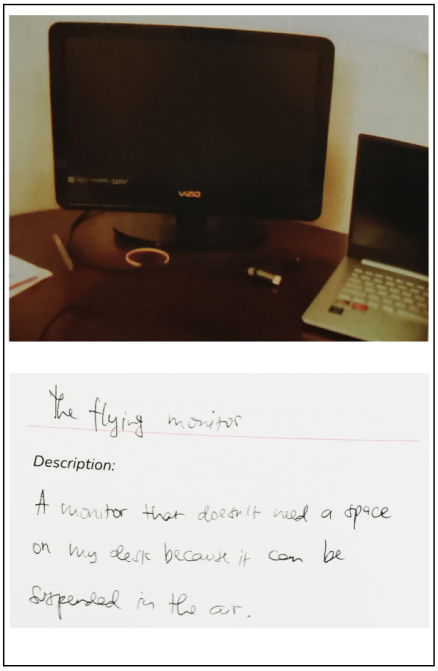
Figure 13: Technologies for enhancing work productivity



(A) P10 - Artistic Hard Drive



(B) P10 - Retractable Office



(C) P6 - Flying Monitor

(D) P3 - Food Anatomy

Figure 14: Technologies for restoring the authentic essence of homes