The Value of Empty Space for Design

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ABSTRACT

We present a study on a group of people who, upon adopting a new lifestyle movement, have discovered and constructed alternative aspects of space. Drawing on 23 interviews with minimalists and participant observations of their Meetup meetings, we highlight the central role of empty space in their lives at home. Our findings show how empty space for minimalists emerge as a new, hitherto unknown space in the home and the ways minimalists seek to create, maintain, and stay sensitive to these empty spaces. Empty spaces for minimalists signify their achievements, exudes aesthetic appeal, and provide a sanctuary away from city life. We propose new opportunities for design based on our findings of empty space. We suggest that design should consider supporting the practices and values that revolve around the absence of artifacts.

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

Author Keywords

Space; Place; Empty space; Alternative lifestyle; Minimalists; Value-sensitive design; Subculture

INTRODUCTION

Many of us as children perhaps remember a time when they, with family or friends, reconfigured and reimagined a room in their home. The living room's couch was dismantled, and its pillows were piled on top of each other to become a fort. Or, a tent was brought into a bedroom and glow in the dark stars were strewn on the ceiling to create a camp in the wilderness. Alternatively, a play room was made more comforting by draping blankets on the floor, rearranging standing lamps and clotheshorses. Parents may find it hard to decipher the meanings and practices happening in these new, alternative spaces created by their children in the home. For parents it may just be clutter, but for the children it is a space for relaxing, playing, and dreaming. Similarly, there are adults who seek to reconfigure their home spaces in untraditional ways that many do not understand.

In this paper, we present findings—not on children—but on how a unique group of adults following the *minimalist* movement construct and utilize alternative spaces at home. Minimalists subscribe to the ethos of living with less; they seek to reduce modern life's clutter [34]. Minimalist motivations are varied (e.g., bereavement, lack of money and time), and most interpret and practice minimalism in their own ways based on what they value (e.g., having a spiritual or eco-friendly lifestyle). Yet, all want to make a serious life change. They do so by re-evaluating what they possess with the goal of focusing on the more important things in life.

Our initial motivation for studying minimalists was to examine the intersection between the values of alternative lifestyles and technological practices. Studying alternative subcultures, as Mainwaring et al. [31] points out, can inform us on how future technologies can support values and practices that are appropriated by mainstream society. Minimalists represent a subculture in which contemporary concerns of HCI (e.g., space and sustainability) are amplified. Like the imaginative spaces built by children, we found that minimalists, as "experts" of space, imbued spaces with deep meaning that reflected new identities and life goals. We found that *empty space*, in particular, played a significant role as an anchor for our minimalists' values. The idea of empty or "other", often ignored, spaces in our paper is relevant to other users/domains (e.g., workplaces) that think about reinventing their spaces.

This paper provides two contributions. First, we discuss how empty space has an overarching presence in our minimalists' homes by drawing upon ethnographic fieldwork that consisted of semi-structured interviews with 23 minimalists as well as participant observations in local Meetup gatherings. We found that minimalists actively reconfigured their living spaces into empty spaces through deliberate de-cluttering of objects and negotiation with non-minimalists of objects to construct empty space. We also identify several spatial attributes of empty spaces. Minimalists both valued physical emptiness (devoid of artifacts) as well as its subjective and symbolic meanings. Empty space is a way of reinforcing the identities and goals of minimalists and provides mental rewards throughout the process of reinventing spaces in the home.

Second, we argue that though empty space may seem to have niche relevance to minimalists, their values in general and practices around these spaces suggest that design may benefit from *respecting* empty space. Empty space, by virtue of its emptiness, seems uninteresting. However, minimalists do work to both create and keep an empty space. Moreover,

minimalists live with and interact in empty space and despite first impressions, empty space is full of activity and meaning. We propose that respecting the value of empty space in design requires that we 1) know that objects and empty space are inexorably intertwined, 2) understand the ways in which people uniquely conceptualize and approach empty space, and 3) define what it means to "interact" with empty space.

RELATED WORK

Space and Place
HCI, CSCW, and Ubicomp communities have discussed the concepts of space and place as formulated by Harrison and Dourish [24] and others (e.g., [10, 17, 25]). Space represents its geometrical and mathematical aspects while place is a space with meanings and values that are culturally shaped through interactions with the space [18, 24, 47]. Dourish expressed the multiple constitutive relationships between space and place, noting that "place comes after and is layered on top of space" [17, p.300]. This definition of space and place ("place = space + meanings") has been adopted by much HCI research (e.g., [2, 10, 13, 30, 49]).

The concept of space and place has been a matter of ongoing intellectual discussion. Brown and Perry [7] conceptualized space and place as largely static, obdurate entities. For instance, it is difficult to talk about how place, a space with meaning, is used in "ongoing action" for online environments since there is no physical space to technically speak of. In order to capture the technological and design issues related to spaces, the authors suggested a focus on the activities that mediate between space and place. Harrison and Tatar [25] partially accepted the idea of a relation between space and place: space is a component of place. But they elaborated on the concept of space by pointing out that the definition "overlooked other elements: people, events, the meaning already associated with the space/place." They further suggested we consider "how places attain and transform meaning" with respect to examining space and place. Harrison and Tatar [25] introduced the term "loci" to indicate a setting that exists *before* a place is created, instead of expressing it as a space. With this term, they intended to avoid misleading designers in understanding spaces, due to ongoing discursive discussions on space across other disciplines.

In a later elaboration, Dourish [17] switched focus from place to our experiences of space. He acknowledged that what we experience in interactions with spaces inevitably involves social practices (e.g., measuring its geometry, navigating, etc.), and both space and place are constructed through our social practices. Harrison and Tatar similarly looked at both space and place as "embodied, experienced phenomena closely related to one another" [25]. Dourish emphasized cultural and social accounts of space as a fundamental matter of our daily life experience [17].

In this paper, we will not delve into the conceptual differences between space and place. We are however interested in exploring alternative facets of space and place that may inform us in designing technologies in space. We follow Ciolfi's [10] belief that it is critical for interaction design research to be "focusing on the experiential nature of space and place, going beyond the analysis of geometric and structural features, and clarifying significant aspects of this experience." The "experiential aspects"of space reflect the idea of empty space. For example, the value of empty space was something that minimalists gradually developed in their relationships with objects in the home; these values were not inherent to the home space itself.

In this paper, for clarity's sake, we will use the term space. This choice is motivated by the fact that most participants used the term "empty space" and used space when describing their minimalist practices. However, our use of space is not meant to background place—minimalists certainly do activities which create meaning [20] and value for empty space. Both space and place are intertwined [17] for minimalists.

Supporting Nuanced Aspects of Space
With interests in space and place in the everyday, there has been growing effort to explore the multifarious aspects of spaces that have emerged through living with it [41, p.ix]. A number of studies in HCI have examined and highlighted more nuanced aspects of space. These works sensitize designers to aspects of space and place that are otherwise often ignored. For example, the notion of "nonplace" by the French anthropologist Marc Augé [3] was proposed to describe a place where people stay temporality without much meaning. This was used by designers for attending to new spaces as a design space and enhancing experiences at physical nonplaces. Cranschaw and his colleagues [13] designed a check-in application for travellers to log their traces at nonplaces (e.g., airport terminal, in a bus stuck in traffic) and share with other travelers. They found that travelers were entertained more in nonplaces through their engagement with the application.

Conceptual tools for space and place enable us to attend to the environments where technologies will be embedded and how technologies should respond to user behaviors. [13]. Ylirisku et al. [49] introduced the term "place presence" as "the influence of a place in people's daily life." In this way, they called attention to a place and people's interactions with it, and considered place presence as a design opportunity. A technologically mediated prototype was placed within participants' home, and participants observed their remote cottage over seven months through the webcam built in the prototype. Participants had stronger bonds to the cottages and perceived the prototype artifacts as an avatar of the cottage. In our paper, we also look at how certain spaces were encountered and how they began to have new meanings in our participants' lives. The new life principles that participants adopted were a catalyst to establishing relationships with spaces and influenced their practices (e.g., decluttering around spaces).

Technologies have also been used in HCI to mediate our perceptions of space and allow us to experience space in alternative ways. Ciolfi and Bannon [11] viewed space as a center for extending the scope of user experiences with technologies. The concept of hybrid spaces as technologically augmented spaces was utilized to create an interactive space design. This case study showed how museum spaces were reshaped when interactive artifacts were offered to visitors to give an extended experience. Matassa [33] proposed a definition of smart space

where a personalized space can be created with "smart" elements: smart objects and people who sense its smartness. He suggested seeing a space as "a composite place where people, objects and physical space cohabit" [33], rather than as being defined by objects surrounding the space (e.g., space as an empty area between objects). We also adopt this idea of space as a collective product by which collective practices and meaning-making are involved.

Transient spaces where people pass through or stop by temporarily like bus stops or supermarkets have been identified as an opportunity for design interventions [8]. Burns et al. [8] created an interactive social game with LED light tokens for an unused local lawn space. Passers-by found the light tokens in the lawn and, by collecting the tokens, they started to join the game that researchers had installed in the lawn. They showed that instrumenting unused space could offer alternative ways of experiencing mundane spaces like a lawn. The above examples show how a space-centric approach can lead to novel and effective technological interventions.

Reconfiguration of Living Spaces
Domestic studies in HCI have examined specific spaces in the home such as the kitchen [38], wardrobe closet [19], and drawers [46]. Other studies have looked at the home overall as a single space (e.g., [45]). Those studies sought to introduce technologies that are sensitive to the particular practices of those spaces. Similarly, Aipperspach et al. [1] imagined different kinds of spatial boundaries (e.g., boundaries between technology-rich and technology-free spaces) at home, suggesting the concept of the "heterogeneous home."

Remodeling and reconfiguring spaces at home bring with it newly discovered meanings of the home. Dong et al. [16] looked at how people read meanings from the traces of their home that previous residents left. Studies of alternative forms of housing [14, 27] or temporary housing for mobile workers [39] have also implied that reconfiguring spatial environments produces different meanings of the home. Petersen et al. [39] showed how non-home spaces like a hotel room or summer house were dynamically reconfigured by nomadic workers so to feel at "home." Researchers labeled this spatial configuration "extending" the meaning of home.

According to critical reviews of 121 studies of domestic research conducted by Desjardins et al. [15], our work is broadly aligned with the home as a site for interpretation in that our work considers the home as a site for reflecting upon objects and people's values. In this paper, we build upon the above studies of the home space by providing a unique perspective of empty space in the home from the view of individuals participating in the minimalist movement—that this is a space for supporting individuals adopting an alternative, nontraditional perspective of values, objects, and practices.

METHODOLOGY

Ethnographic Fieldwork
Our fieldwork lasted over nine months (July 2016 to March 2017) and involved participants observations, semi-structured interviews, and visual minimalist exercises (explained later).

We first joined three different local minimalist Facebook Meetup groups across the United States. Two groups were for minimalists from two cities in the Midwest with 731 and 374 members (as of 2017 July) and one group was for a West Coast city with 813 members. Both were chosen because they were geographically accessible to the researchers. Every week, we observed discussions (e.g., media articles, questions or tips about minimalism) and pictures representing minimalist lifestyles (e.g., empty shelves or trash bags they would throw away). The online observations allowed us to gain access, become fluent in the vocabulary, and attain legitimacy in Meetups—all hallmarks of ethnographic fieldwork. They also shaped our interview protocol (e.g., what do you like best about your home?) and visual minimalist exercises (e.g., how has your way of using space for things changed?).

We conducted in-person participant observations of Meetup group meetings. We disclosed our intentions with Meetup leaders in advance, and, during the meetings, we introduced ourselves as researchers. We attended five Meetups between September 2016 and February 2017. All meetings were audio-recorded except the first one (due to privacy concerns echoed by some members). Each month, the Meetup organizer would choose a timely topic to discuss that was of interest to other minimalists. For instance, a meeting a few weeks before Thanksgiving was dedicated to avoiding compulsive shopping and gift giving during the holiday season. At times, the agenda was proposed by other members, which often represented current major interests or challenges in their lives. These gatherings allowed members to meet other minimalists in the area to share local information (e.g., where to donate or trade secondhand goods) or personal experiences (e.g., their challenges and solutions to minimalist practices). Meetings were typically held at a local library or a community center; attendance averaged eight members at a time.

In addition to these Meetups, we visited a tiny house roadshow in the Midwest and a tool library on the West Coast each for a day because they were mentioned by the minimalists in our fieldwork [32]. During these daylong observations, we did observations and informal conversations with around twenty visitors and staff. We thus could gain a partial, albeit incomplete, perspective on how the minimalist lifestyle is aligned with other alternative attitudes towards housing (e.g., vans and campers) and objects (e.g., the Buy Nothing movement and Zero waste living).

These participant observations allowed us to build rapport with local group members. This fieldwork proved invaluable to identify and recruit minimalists for our later interview study [26]. Our field notes and materials (e.g., brochures and pamphlets) collected throughout this series of engagements were analyzed, along with our interview data.

Interviews and Visual Minimalist Exercises
Along with our participant observations, we conducted semi-structured interviews with 23 adult minimalists—20 participants were in the US and three in Korea. Participants in the US were recruited from three Meetup groups located in two Midwest cities (N=13), one Meetup group in a West Coast city

(N=6), and a Facebook group for minimalists (N=1). Interviews lasted 1.5 hours on average, ranging from 50 minutes to 3.5 hours. Interviews often took place before or after Meetup meetings; otherwise, we conducted interviews at places such as cafes and public libraries that participants suggested. One minimalist Meetup leader invited us for a home tour.

In terms of three participants in Korea, we interviewed them in South Korea individually. All are well-known members in the Korean minimalist community—a book author, a blogger, and a community leader. Based on our observations of the online activities of minimalists, we found that minimalism is not a movement limited to the US; we frequently encountered online articles and video clips featuring minimalists in Asian countries, and minimalism has gained a wide following in East Asian countries such as Korea and Japan. To obtain a more global perspective on minimalism, we recruited minimalists from Korea via their email contact information found in their blogs or online communities. These interviews were conducted face-to-face in Korean by the first author, a native speaker of Korean; they were transcribed and translated to English.

Our participants in US and Korea were in their late 20s to early 50s, middle-class, and urban workers living in metropolitan areas. Their years practicing minimalism ranged from 1–20 years, averaging 3.5 years. The participants were mostly female (18 females and 5 males). Although there are no official data about the gender makeup of minimalists to the best of our knowledge, we did observe that most participants in offline Meetup meetings were female. We did not find significant differences between female and male minimalist interviews. During the interviews, other factors such as major events in their life (e.g., a breakup) were often emphasized rather than their background.

All interview protocols began with background questions that asked participants how they learned about minimalism and what motivated them to adopt this lifestyle. This was followed with questions regarding how minimalism has changed their lives with respect to routines, habits, possessions, relationships, and community interactions. After several interviews, we revised our interview protocol to also ask how these aspects pertained to their sense of space. All interviews were audio-recorded and transcribed for analysis.

Visual Minimalist Exercises
During our interviews, some of our informants (N=11) were asked to participate in what we called a visual minimalist exercise. This exercise was developed to elicit from informants a more detailed account of how their minimalist practices progressed over time in their homes, which may be difficult to capture solely through interviews. We now describe our exercise in detail. We first asked informants to choose a specific space (e.g., closet) that has been changed due to adopting a minimalist lifestyle. The informant is given a handout comprised of four blank boxes depicting four different stages of a minimalist: "Pre-minimalist State" (before becoming a minimalist), "Initial State" (soon after becoming a minimalist and having done some downsizing), "Current State" (what their chosen area looks like now), and "Future State" (what the cho-

sen area will look like in the future). Informants were asked to sketch and label their chosen spaces in each of the blank boxes (e.g., drawing how furniture and objects were arranged). Because empty space was identified as an important concept for minimalists in interviews, we also encouraged informants to indicate empty space in their sketches by drawing circles of any size. Depending on their comfort level in drawing, we allowed participants to either draw the actual objects in their chosen spaces or simply triangles to represent objects. We asked informants to describe each space they drew and the changes between stages. All completed exercises were collected and photographed for analysis.

Data Analysis
Following the grounded theory approach [9], all authors individually coded all the data from field work-observations and interviews In total, we generated 436 codes from open coding, which were narrowed down to a few major themes. These major themes were determined through affinity diagramming. For example, data coded as Space, one of our parent codes, were classified into 25 sub-themes (e.g., space: reflecting identity, space: a transition stage, space: for valuable objects). We continually went back and forth between our codings and our data to ensure that they fully encapsulated the practices and values of minimalists. Empty space was a key theme that consistently arose in our analysis.

We did not find noticeable cultural differences in our data with respect to minimalist values and practices. Instead, we found many commonalities in the codings produced from both our Korean and US informants. This commonality may be explained by the fact that US and Korean minimalists rely on many of the same information resources for minimalism (e.g., particular blogs, podcasts, and books) and have similar ancillary interests (e.g., sustainable living, fair trade). We will not claim our data represents a global perspective on minimalist practices, but, for clarity's sake, we will not draw a distinction between Korean and US participants.

FINDINGS
Based on our interviews and results from our minimalist visual exercises, we describe how minimalists engage in empty spaces at home. We first illustrate a common narrative among our minimalists, namely that they fortuitously discovered the importance of empty space; we describe how empty space became one of a kind to our minimalists. Next, we show how minimalists engage with empty spaces by actively constructing and maintaining them. Lastly, we show the benefits of empty space, or, the charm of empty space. All quotes have been anonymized and associated with a participant ID (P1–P23).

The Discovery of Empty Space
Living a minimalist life means to be mindful of what things bring value into their lives. Informants began their new lives by constantly reflecting on their material possessions. This reflection inevitably lead them to scrutinize what they own in spaces of the home they occupy everyday. Empty space itself then became a space that they had not carefully thought about before becoming a minimalist. Minimalists found that empty space in the home had grown on them since they began

following minimalist values. P7 told us that over a span of two years as a minimalist, he discovered the value of empty space: *"The emptiness actually brings a lot of joy. Like I said, if I don't have anything, I might have more space than I need. But I learned that I like the empty space. Just because I don't have stuff, doesn't mean I have to live in a closet...You never know unless you experience what you like. Just that what I found fits me."* Additionally, P8 looked back to how he used to simply see space in the home as something for storing objects, something that needed to be occupied: *"I used to think how I can fill the empty space. But now, I don't want to fill up anything anymore. Then I came to realize it looks nice the way it is...Whatever I have in the closet is what I need."*

Upon learning how empty space brought them joy, minimalists wanted to create and keep empty spaces. For example, P6 became obsessed with empty spaces and tried to make sure that she had enough empty space: *"We don't put items in the empty rooms...Even though I have a lot of space, I probably won't use up all my space just because I so value space...if I had something, like another table, it takes up surface area. I still try to have a lot of surface area, like a lot of floor."* For her, empty space is something that deserves to be kept on its own merits. She needs to put in the effort to maintain the empty space, just as one saves money: *"It's almost like the rule, even if you have a lot of money, you shouldn't spend it."*

The metaphor of valuable empty spaces can be taken further. Some minimalists (P5,7,8) drew an analogy between empty space and money. P7 noted that the joy he received from empty space itself was worth money. Having items in empty space nullifies its value:

> The empty space is actually money. If you live with 400 square foot per month for $800, you're actually paying $2 per month for 1 square foot. If you buy a treadmill and it takes up 30 square foot, it's the same as if you're paying $60 every month. People don't think it costs more to have things. They just believe that they're keeping it. It is the same as giving away $60 just to keep it in the space...30 square feet is huge...But I think having space can be quite amazing. I feel comfortable when I see an empty space.

Keeping a space empty was both financially and mentally valuable.

Upon discovering empty space, the home was reconfigured to center around empty spaces. For example, P19 felt that empty spaces redefine the meaning of the home. Just having more empty spaces made him feel more satisfied with his home: *"If today you put me back in a house where I used to live, I wouldn't be happy. And maybe if you put the person that I was before into the house that I have now, I might not be happy."*

Visible Indicators of the Minimalist Identity
Minimalists imbued empty space with deep meaning. Empty spaces were seen by minimalists as a representation of themselves or of a life they strove to achieve. For example, P6 describes her Saturday morning routine of admiring her spaces, spaces that reflect who she is and the life she has chosen: *"I'm proud of the person I've become. I'm proud that my space represents who I am now. If someone, a complete stranger were to walk in this space, they could probably tell what kind of person I am. It's almost like my soul mirrors my living space."* Likewise, P18 regarded her empty living space as an embodiment of her life. She wanted to treat her living space as mindfully as her life: *"I think I just respect the space that I live in because I want to respect my life."* In this sense, minimalists tied their identities with their spaces. They also felt a responsibility to treat empty spaces seriously: *"If you utilize every single corner that you own it's the most responsible you can possibly be to yourself"* (P6).

Outwardly, non-minimalists were able to recognize a home as a minimalist home. Such a home has distinctive and copious amounts of sparse and empty space. P4 mentioned, *"A lot of people I noticed were like, 'Oh, yeah, this is Maria. She has nothing in her [home]...She has empty bedrooms.' "*

Constructing Empty Spaces
After recognizing the presence of empty space, minimalists carefully and intentionally created empty spaces at home. Empty space cannot be done for the sake of empty space:

> It comes to a point where you've gotten rid of so many things and then there's so much space and time that you don't know what to do with it...It's really important...during the journey, to identify what are your priorities in life. Once you do that, make sure that everything you do [for spaces] aligns with those priorities. Because otherwise you're going to have an empty house but it's still going to be an unhappy house. (P5)

Thus, minimalists consciously constructed empty space. We will describe how they constructed empty space by zealously guarding their home from outside objects, shifting their perspectives on what objects deserved to be in their spaces, and constantly challenging themselves to remain sensitive to empty space. Each of these strategies was carried out in service to their values as minimalists.

Curbing Materialism
Our minimalists strove to prevent excessive or unnecessary objects from being introduced into their homes. Minimalists did not want objects to be brought inside and take up space in their homes. How objects were placed or thrown out in the home were important considerations for our minimalists to construct empty spaces. Objects in their home needed to be aligned with their minimalist life values, just as with spaces. For example, P14 described how she carefully chose certain objects for her space, *"Some of the other criteria I have is whether or not I think it would fit my new lifestyle."*

When selecting objects, minimalists thought over whether an object was a necessity in their spaces and life. Their criteria for selecting objects did not always fit the norm—necessities for others could be gratuitous clutter for our minimalists. As a minimalist, P9 noted that he knows filling an empty space is not necessary: *"A lot of people think that way. You got to have the necessities. You need a desk. But the urge of filling an empty space is not necessary. If you have stuff that you don't need, you better not have them there. Otherwise, it would*

obstruct a view...also it would makes you feel not neat and clean."

Our minimalists held firm to such principles, often eschewing the marketing of deals or hype of consumerism. One minimalist criticized how people were obsessed with bargains and thoughtlessly accumulated objects in the home.

> The last time I went to a conference, they have all these giveaways. People are just grabbing every single giveaway. I'm like, "What are you going to do with all this stuff? Do you really need that?" It was a foam guitar. What are you going to do with that? [Meetup Meeting]

Controlling consumption and selecting objects wisely was a life-long practice for minimalists. P10 mentioned a new scarf she bought with much deliberation: *"To people like us who all understand each other, it's fun to get rid of stuff and not buy stuff because it's on sale. Like that scarf, I ended up buying [it]...but I'll wear it to death."*

Seeking Certain Kinds of Objects

With this desire for more empty spaces was a preference for certain types of objects in the home—for example, smaller or disposable objects and built-ins (furniture that are incorporated into the home). Buying smaller objects allowed one to protect their empty space. P12, who is a big fan of watching movies with his wife, replaced his TV with a smaller one: *"Even after we sold off our TV and our entertainment center and all that stuff, we didn't really regret it...because we ended up getting smaller, more compact things to replace it. Instead of having a piece of furniture and multiple devices, we basically just have a TV and a speaker and that's it."* Afterward, he again downsized his smaller TV to portable gadgets—an iPad with headsets: *"We're trying to figure out is there a way we can still, once in a while, enjoy a film without having to have a television. Can we somehow use...a tablet or something with headsets to still get good sound and good picture without having to have this big home theater."* For him, having more empty space took priority over enjoying his hobby fully.

Built-in furniture was used to ensure ownership of less objects. P14 remarked that objects often need other objects to function (e.g., a lamp needs to be placed upon a table). For this reason, P14 sought objects that could be built into the wall or ceiling without occupying floor space. *"I don't like a ton of lamps, that's one of the things when we were looking for homes was overhead lighting because I don't want to have a table where I have to put a lamp on it. That to me is more clutter. If I can have those spaces open that's nicer."*

Disposable objects (e.g., plants, food) or gifts that provided memories or experiences (e.g., concert tickets) were preferable since they did not consume space or temporarily take up space. For example, P1 followed these criteria when selecting objects for her space: *"I would rather have things that are consumable, like food or flowers, or things that go away after a while, or experiences. Or gift cards, free money. As opposed to...a snow globe or these things that just sit around and collect dust."* The objects she did allow would not, eventually, occupy space in her home.
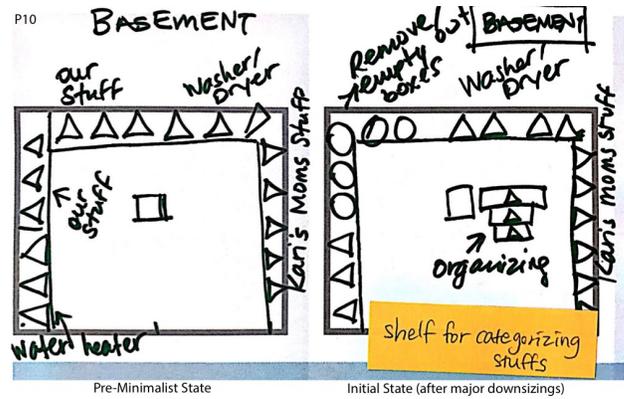

Figure 1. Basement beginnings (circle = empty space, triangle = stuff)

Negotiating Objects with Non-Minimalists

This preference for consumable objects sometimes helped minimalists maintain social relationships. Buying food instead of space-destroying physical objects was a way of hanging out with non-minimalists at a mall. This also allowed minimalists to participate in non-minimalist activities in their own terms. For example, shopping is a common activity among friends. P6 described how she was able to participate in this activity without awkwardness while still preserving her values: *"I couldn't go to the mall with them unless I just went to keep them company. That was my ultimate excuse. I was like, 'I'll just go to keep you company' or if we went there and they bought something, and then I bought ice cream instead."*

Minimalists applied this strategy to gift giving as well. P6 told us, *"When I transitioned into minimalism, that was really hard, especially, when people want to give me gifts. I had to come up with an answer...that wouldn't insult them. I would tell them, 'Oh, give me food,' so, at least, I could eat the gift. They don't feel bad. I don't feel bad saying, 'No.'"* With respect to gifts from others, our minimalists had to clarify their preference to others for consumable objects. This was one way of avoiding unnecessary objects for their home.

Progressing through Layers of Empty Spaces

Our minimalists gradually constructed their empty spaces. Via our minimalist visual exercises, we were able to see how minimalists developed their empty spaces over time. Crucially, in progressing through their decluttering practices, minimalists conceived layers of spaces. The term "layers of spaces" denotes one space that is comprised of multiple spaces, located vertically (e.g., spaces inside a drawer and on top of a dresser) or adjacently (e.g., spaces inside and outside of a closet). In other words, spaces can be nested within spaces, and minimalists approach decluttering in layers—for example, decluttering an entire layer before delving up or down another layer.

In our visual exercises, minimalists often mentioned first gathering small objects and fitting them into a particular layer of space (e.g., inside drawers, inside cabinets). Thus, our minimalists would first secured spaces for those objects. For example, P10 said, "I want to condense everything to these shelves" while she drew three levels of shelves in the center of her basement (Figure 1). She put the shelves in the base-
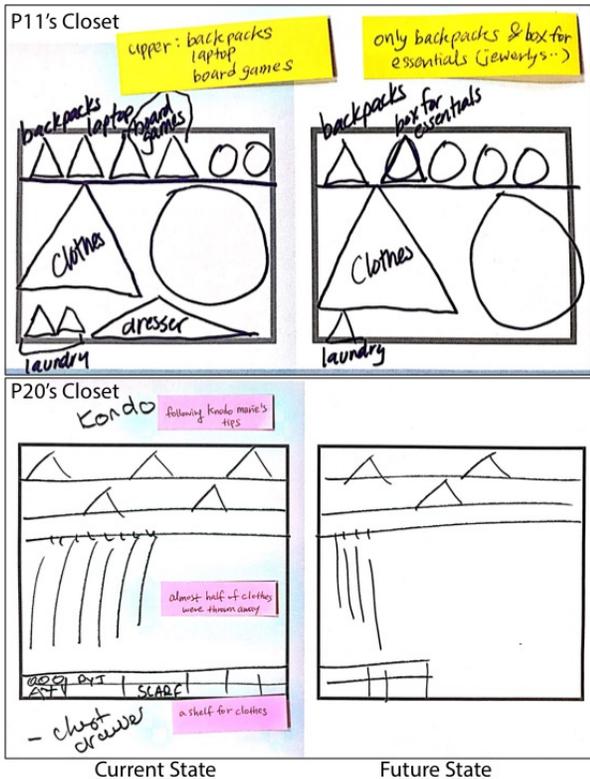
Figure 2. P11 (top) & P20 (bottom) closets in current and future stage

ment for the purpose of categorizing her objects according to whether she would discard them or not. She put all the objects that she would get rid of soon together on shelves. P12 also created more empty space in his workspace by disposing large objects as well as moving objects on his desk to a file cabinet in the desk: *"I got rid of the monitor and the keyboard, basically just work straight off the laptop. Everything, all the papers and everything went into the file cabinet. I downsized and got rid of a bunch of the papers and whatnot."* Thus, a key way to declutter for minimalists was moving objects into a different layer of space (e.g., on the shelf, inside the cabinet) to put objects out of sight. These temporary "holding" sites for objects to be disposed of visually welcomed new empty spaces to emerge.

Minimalists first decluttered objects that were within a space (e.g., inside drawers). They would then move on to the space (e.g., drawer) that held said objects. For example, P11 and P20 drew closets during the visual exercise. They did not remove their dressers until the dressers themselves were emptied (Figure 2). Similarly, a shelf with layers of space was the last thing to be decluttered for P14; the future stage drawn by P14 depicts nothing (Figure 3).

Being Sensitive to Empty Space
We also found that minimalists cultivated a sensitivity to spaces. For example, our minimalists treated empty space like objects. Spaces were arranged like objects; they were arranged in aesthetically pleasing ways (e.g., symmetrically, distributed evenly). For example, in Figures 1, 2, and 3 empty spaces were lined up with objects on shelves. P14 commented
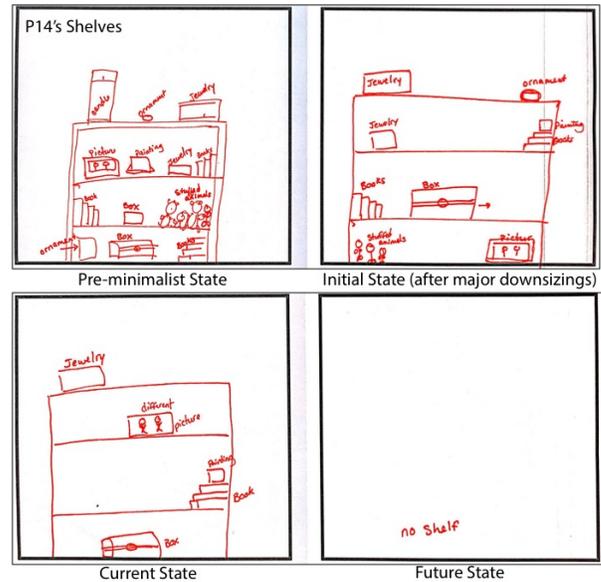

Figure 3. The stages of P14's shelves

about her preferences to arranging objects and empty spaces in a balanced way: *"I like things to be either symmetrical or there could be like three things of different height over here and this side could be empty."*

Also, our minimalists forced themselves into smaller spaces to remain appreciative of the value of empty spaces. For example, minimalists factored in the size of their homes when considering how to create empty spaces. According to P11, a bigger house unfortunately gives people an excuse to keep clutter in the home, and this may lead them to become desensitized to space: *"I used to want a very large house to have all my stuff in, and now I don't really feel like I need that...a person doesn't need what they think they need. Because people have what they have, as far as huge houses."*

Downsizing living spaces allowed minimalists to keep up with decluttering and stay sensitive to their empty spaces. For example, P23 moved three times to progressively smaller houses over his minimalist life. His journey as a minimalist began in a 800 square foot apartment. He started by paring down his objects. *"I would start kind of section by section. I would just try getting rid of or donating some stuff in this section of my apartment and see how it went...it kind of snowballed and after a year in my 800 square foot apartment, I moved into a 400 square foot studio...and I started realizing that the thought of living without a lot of this stuff is not a big deal."* Getting used to living in smaller house spurred him to consider moving yet again. When asked why he kept moving to smaller houses, P23 told us that *"as little bit of a test to myself, because that forced me to pare down even more...I currently just rent a room from a guy that I met. Right now I just have a room ...even smaller than 400 square feet."* By challenging himself in smaller spaces, he also learned how to secure enough empty space for him to feel comfortable.

The Charm Of Empty Spaces

Through the creation and experience of empty spaces, minimalists discovered the charm of empty spaces: spaces reflected a sense of accomplishment, provided aesthetic satisfaction, gave mental comfort, and were a sanctuary away from city life.

Reflecting Achievement

Empty space was a visual indicator of the time and effort participants had made in decluttering in their home. Participants used empty spaces to visually check the progress of their minimalist practices. They were proud of their empty spaces because they represented milestones towards a minimalist life.

> My reward is when I can look at my space and almost say, "Good job." It's because you come to that point in your journey where you can stop and sit back a little bit, and relax a little bit...it takes a lot of time to go through every single piece that you ever bought or every single knife or fork or spoon you own, and say, "Do I like this, do I like this, do I like this?" When you get to the point where I'm at, I think it's really, really rewarding...I think that [the empty spaces in home] is my favorite reward. (P6)

Creating empty space was not the final goal for our minimalists; rather, it helped them gain a toehold in the minimalist lifestyle. P6 noted that her empty space was a place full of potential to achieve something. She drew an analogy between empty spaces and snow. Having a thick layer of snow on the ground provided the promise of opportunities—the promise of snowboarding. Similarly, seeing empty space provided the possibility of a place where she could progress towards a life she desired. She kept saying that *"[t]he space, it's almost like it's a dream come true. It's kind of like that. Everything you always wanted, you never thought you could get there, and then when you get there, and you're living the life that you wanted, I think that's the ultimate reward for me."*

Empty space also opened up opportunities for positive activities. For P8, it was where one's imagination could be unleashed: *"When it's empty, I can fill the space in my own imagination"*, and, for P19, it was a place to have enhanced social interactions: *"You can have people over, more comfortably. You can entertain more people...If you have too many living room chairs, for example. People aren't going to be able to move around at a party, as easily as they would otherwise."*

Aesthetic and Mental Satisfaction

Minimalists hailed the aesthetic charm of empty spaces in the home. Empty spaces were described in sensuous terms as breathable, clean, not visually distracted, harmonious, peaceful. *"Just open areas, so it's breathable. You don't feel like contained. My bedroom is very sparse. I walk in and it makes me happy...I think it clears your mind. (P3)."* As P3 described empty spaces as an immaculate and unoccupied area of the home, P12 also described his impressions of empty space as having *"clean lines, clean walls, it's very relaxing."* Emptiness gave P10 *"less visual distractions"* in his spaces at home.

In a close connection to aesthetic pleasure, emotional comfort was another benefit of empty spaces. Both aesthetic pleasure and comfort were something they could only find at home.

For example, P8 described how empty spaces made his home a haven: *"I think the most comfortable thing is an empty space in my house. Looking at an empty space makes me feel relaxed... Stuff I need is in the mall, and I can find them in the market. But I just don't bring them with me because the empty space makes me feel more comfortable."* Unlike shops and stores, empty space was clutter-free so that our minimalists could feel at ease within the space.

Minimalists found tranquility by simply being in the empty space or being surrounded by it. For example, P7 said, *"I think having space can be quite amazing. I feel comfortable when I see an empty space."* It became an everyday routine for minimalists to simply think and dwell about the presence of empty space in their home. P11 mentioned, *"Every day it's nice to know that there's nothing in that cabinet up there."*

This serene feeling stemmed from not feeling obligated to do something (e.g., maintenance) for things. Things in the home were not only distracting but also needed to be taken care of. For example, P6 who sometimes works at night said, *"It just bothers me when there's stuff everywhere. It makes me feel a little bit claustrophobic. It makes me feel like stuff needs to be done... If my house is a mess while I'm doing it [her work], that's in the back of my mind and it's distracting me...the best way to organize is to get rid of your stuff."* Similarly, before having empty spaces, P12 described how he could not fully relax because of the objects in his home: *"I think it's easier to relax. Because I feel like before minimalism we were surrounded by reminders of other things we needed to do, or other things we should be doing...I'd walk by my home office, 'God I really need to get that cleaned up.'... or you're like, 'Oh, I haven't mowed the yard yesterday, I've got to mow it now.'* For many of our minimalists, objects made them think about tidying up objects or unfinished, looming tasks.

Sanctuary from the City Life

Empty space gives not only comfort from the responsibility of things in the home but also from the hustle and bustle of city life. For example, with respect to the pleasure surrounding empty space, P20 made a comparison with going into nature: *"I feel like if you're walking on the beach or taking a walk in the forest, all of a sudden you're not stressed at all, rather than walking in the city surrounded by cars that are honking. So it's pretty much the same at home. Like if your home is well organized and clean then you feel better."* The busy city environment surrounding our minimalists' homes highlighted the placidity of empty space that made homes a sanctuary. P12 explained how he could put himself together in his empty space: *"One of the best things about coming home is it's so peaceful. It's so quiet, there are no visual clutter, there's nothing to take your thoughts away from the moment. It's easier to be in the moment with what you're thinking about or what you're doing because you don't get distracted by something else going on in your space."*

Our minimalists longed for calm and comfort because they were tired of their busy urban life and unnecessary relationships. P13 needed a "sacred space". Empty space gave her a peaceful and secure feeling when coming home from work. It gave her better control of interacting with the people that

mattered to her, *"The good thing is I'm no longer surrounded with people I really don't want to be with, it has no meaning. But I'm just around them. . . It [empty spaces in home] gives me time to be introspective and to meditate and to pray and to really be in that different space. Instead of this busy world, I go into a sacred space" (P13).* Some of our minimalists turned their phones off or left their laptops when they were in the empty space to disconnect with the outside world and focus on themselves. P19 sums up her experience of empty space, saying, *"I really consider it [empty space] to be my sanctuary when I am home. So it's really nourishing to me."*

DISCUSSION: RESPECTING EMPTINESS

In adopting minimalism, participants related a journey of self-discovery intimately tied to their new practices. We have teased out one central aspect of this journey, that of discovering empty space. Empty spaces provide respite from a mainstream society obsessed with consuming, owning, and being judged by material goods. Minimalists consciously think about creating, reinforcing, and remaining sensitive to empty space. Thus, minimalists are especially attuned to empty space.

In this section, we discuss what it means to design for empty space. Designing for empty space is not about how to fill or exploit an empty space. We suggest that it is about having an awareness of empty space and thus deliberately designing in a way that *respects* the presence of empty space. By learning how minimalists value empty space, we can begin to appreciate "other" spaces—spaces that are outwardly invisible yet lived-in. We describe three aspects of our findings on empty space that can open up new design opportunities. First, we attend to the relationship of empty space with objects, which highlights the absence of artifacts in a space. Second, we point out how minimalists conceptualize empty space as have specific attributes (e.g., a limited resource, having layers of spaces). Lastly, we discuss what it means to have interaction with empty space.

Relating Empty Space with Objects

Advances in tangible interfaces, ubiquitous computing, and embedded systems have naturally led interaction designers to focus on artifacts. In this line, artifacts rather than spaces are the first-class objects of interest to HCI. For instance, exemplary work by Odom and colleagues [37] has investigated why people keep or discard objects in their home to inform the design of durable technologies that people could grow strongly attached with. The authors drew from Verbeek's [48] three design perspectives to analyze various objects: function, symbolism, and material qualities. While we do not use this lens to describe our results, our fieldwork shows that minimalists can indeed be considered as evaluating objects across these perspectives. Factors minimalists considered included whether the object satisfies a function that is needed, whether the object symbolically aligns or represents their values, and whether the object was composed of material qualities that would not occupy space (e.g., built-in furniture, table vs floor space) or only temporarily occupy space (e.g., consumables).

In this light, emptiness could be seen as a byproduct of disposing and keeping objects. However, for minimalists, empty space and artifacts are coupled together. As we described, minimalists sometimes see empty space as object-like. Thus empty space had particular material, functional, and symbolic attributes that made it desirable, more desirable than artifacts themselves. Odom et al. [36] suggest that the design of digital heirloom objects needs to examine how technologies can be "put away." Building on this, if we are to consider digital artifacts in the wider ecology of other things in the home, we should include empty space as an element of this ecology. Empty space itself reminds minimalists that they have no obligations towards the objects that *might have* otherwise been in that space. This freedom from obligation means freedom from evaluating the object's worth and its maintenance and repair. However, obligation also means freedom from the symbolic attributes of the object—for example, minimalists also created empty space to purge themselves of past memories, to start afresh (e.g., from past relationships). This means that empty space itself has great symbolic significance.

We also believe that designing for empty space has possibilities for sustainable interaction design. Blevis [6] argued for "renewal and reuse of existing objects and systems." Bates et al. [4] also warned about the increasing amount of devices in our home and emphasized "repurposing" as an approach to sustainability in HCI. We also believe that empty space could help designers support sustainable behavior. Thus, rather than attempting to modify one's behavior for lofty goals such as reducing one's carbon footprint, electronic waste, and pollution, setting a goal to increase empty space for the sake of one's minimalist values (e.g., simplifying their lifestyle) would be a more tractable goal to reach. Minimalists make empty space because of their new life principles, rather than for sustainability. Researchers have recently called for more practical approaches [43], suggesting that approaches intersecting with personal values may have more of a direct impact on one's daily practices. Empty space is "easy" to understand—in some sense, it is both a "free" ambient technology and a technology that aesthetically demands your attention.

Navigating Empty Space

Our findings elucidate how minimalists conceptualize and deal with empty space. Because it is so easily overlooked, minimalists adopted strategies to ensure they remained sensitive to emptiness. A study by Jones and Ackerman [28] of an online minimalist forum pointed out that limited storage motivated individuals to declutter and curate their collections of objects at home. To add to this, we found empty space was treated as a limited resource and contained multiple, nested layers of spaces. In this section, we examine how we might find opportunities in how minimalists conceptualize the spatial aspects of empty space.

The notion of layers of spaces shares sympathies with Foucault's third principle of heterotopia [44, p.160] in which a single space may consist of several spaces. Foucault [22] draws the analogy of gardens that were regarded as sacred spaces whose objects (e.g., fountains as the center of the world, vegetation as microcosm of the different parts of the world) have deep, different meanings. Similarly minimalists do not simply see their homes as homogeneous but rather as consisting of

many different spaces. When minimalists declutter, they do so in stages, regarding each container (e.g., shelf, dresser) as its own microcosm that may have empty space. Aside from storage, we also noted holding sites (e.g., basement, a front porch) where our minimalists placed objects temporarily before decluttering. Designers may consider the various stages in which spaces are cleaned or used as holding sites to create empty space.

It is fruitful then to ask whether designs can embrace a granular perspective on space (e.g., inside, on top, underside). For instance, minimalists often thought about how objects in use, while temporarily intrusive, would eventually cease to be intrusive upon being stored (though minimalists often kept going deeper—thinking about clearing storage). Thus the lifecycle of an object's use in terms of space—where is it, when it is used, when it is not used, etc.—in multiple spaces needs to be considered. Each space may represent different stages of a minimalist's life.

Another way minimalists dealt with empty space was to treat it as limited. By limited, we mean that minimalists learned to not take space for granted. Significantly, we found minimalists would sometimes go to great efforts to remain sensitive to empty space such as moving to a smaller home. Thus, rather than trying to always augment space (e.g., via virtual and augmented reality), we need to consider how designs may support an understanding of the limited nature of space. This suggests that designs should examine how the intentional limiting of space for specific purposes allows us to preserve and respect empty space as an important resource.

One way to highlight its limited character might be to associate empty space with a financial value. Some minimalists operationalized the area of empty space with money. We believe ways to measure and characterize empty space, not simply in terms of area, but other more meaningful concepts like money or perhaps history significance (what was given up to create the empty space, or how has the space been maintained) may allow us to better respect empty space.

Interacting with Empty Space
While interaction with tangible artifacts has been a mainstay of HCI and CSCW, what it means to interact with empty space, something that on first glance seems invisible, is less clear [12, 29]. Minimalists, on the other hand, interact with empty space. We would argue that interactivity still exists when people intentionally "leave" a space as it is. Minimalists actively engage in a number of strategies to ensure that empty space is left uncluttered or that new empty space can be created. Once created, empty space is a lived-in, visible, yet invisible space. Thus, interaction with empty spaces is not simply the negation of interaction [40]—e.g., non-use [5] or inaction—it is an active interaction. This active interaction happens in the everyday rituals of empty space in the homes of minimalists. We again allude to Foucault's [22] "other spaces" (heterotopias) but on its fifth principle. An empty space is not a public space but rather a space *regulated by rituals*. In order for empty space to be "used," minimalists engage in particular, permissible activities, activities that allow them to legitimately use the space. These activities include looking around, staring,

reflecting, and feeling, emotionally, the space. The space must be protected via de-cluttering and rigorous filtering of objects.

The notion of interactions that go beyond physical manipulation is especially relevant to research on public displays (e.g., [2, 35]) and civic designs (e.g., [21]). For example, Akpan et al. [2] showed that gazing and observing at a distance were also ways for onlookers to interact with an interactive design space. The notion of "gazing" upon empty space is not simply about reading and processing information for minimalists. Rather, gazing gives minimalists, for example, a visual indicator of their identity, progress, and values. Gazing also has an aesthetic quality; gazing upon empty space elicited a sense of meditative clarity and relaxation.

Interacting with empty space also means reflecting on the history of space (c.f. the History Tablecloth [23], traces in the home such as wallpaper [16]). While designs may see empty space itself as devoid of interest, we may ask whether technologies can help us reflect on how a space came to be an empty space. Many minimalists felt that rather than restricting the possible activities that could happen, empty space in fact gave them greater freedom and comfort that they would be able to accomplish anything. Thus, its very neutrality in shaping activities may be a strength of empty space, as opposed to, for instance, a "gaming" space that only suggests leisure activities. Designers should consider how empty space allowed minimalists to carry out "interpretative appropriation" [23] or multiple interpretations [42].

CONCLUSION
In this paper, we have described the value of designing for empty space. By focusing on minimalists, we were able to gain close insight on what it means to treat empty space as a first class object, one that deserves respect and represents—both visibly and invisibly—the new values our informants have adopted. While our findings draw from our ethnographic work on minimalists, we believe their practices and values can inform designers concerned with technologies for any sort of space that has long-term engagement. For example, the workplace, second homes, and third places (e.g., libraries, cafes) are all locales we regular interact with and, moreover, contain "other" spaces—spaces we regularly overlook. Spaces like dusty corners, closets, and storage boxes can be considered other spaces. Attuning ourselves to empty space suggests that we scrutinize the relationship between object and empty space, the ways we process empty space, and how we appreciate and interact directly with empty space.

Future work should investigate how technologies can support these three focal points of empty space. For instance, while previous designs have examined gazing at spaces, these studies have the end-goal of designing new technologies to be placed in these spaces. Instead, we ask whether we can study the ways in which we interact with (e.g,. gaze upon) space for the sake of designing technologies that support empty space rather than inserting and thus destroying the very qualities of empty space that people enjoy. Such technologies show promise to give the same aesthetic, mental, and spiritual benefits that so transformed our minimalists' perspectives on space.

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