Extraordinary Computing:
Religion as a Lens for Reconsidering the Home

Susan P. Wyche and Rebecca E. Grinter
School of Interactive Computing and GVU Center
Georgia Institute of Technology
85 5th St. NW
Atlanta, GA 30308 USA
{spwyche, beki} @cc.gatech.edu

ABSTRACT

We present results from a study examining how American Protestant Christians' faith affects their domestic life. There are two contributions of this work for the HCI community. First, we provide empirical evidence demonstrating how topics of interest to HCI researchers (e.g., material artifacts, routines, and ICT use) are used for religious purposes. Our findings show how Christians distinguish these aspects of domestic life from their secular counterparts. Second, we use our findings to reflect on current directions of future domestic ICT applications. Specifically, we critically evaluate the "problem solving" approaches dominating the design of future technologies, and present *extraordinary computing* or systems that promote and honor the special value accorded to some aspects of domestic life.

Author Keywords
Religion, domestic technologies

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

As Information and Communications Technologies (ICTs) have entered new domains, so HCI has developed new foci to ensure that our understanding of human-computer interaction reflects all usage possibilities. One significant area of focus has been the home. Recently this interest in studying a broad range of ICT usage has extended to examining how religious groups and individuals use ICTs to support their faith [2,37,38].

Despite this increased attention, religion may seem an unusual topic for the HCI community to explore. And yet, like other researchers, we suggest that considering religion has much to offer HCI research, because it influences how

billions of people adopt and use ICTs [2,37,38]. Reports estimate that there are 2.1 billion Christians, 1.2 billion Muslims, and 800 million Hindus worldwide [32]. These numbers challenge the prediction that modernity (based in part on science and technology) would lead to secularization (i.e., societies migrating away from close identification with religious institutions) [3,17]. Significant evidence exists that the secularization thesis has not come to fruition, and that technology has and continues to contribute to the global success of religion.

The telephone, television, mobile telephony, satellite broadcasting, Internet-based media streaming, email, and the World-Wide Web [6,7,14,23,33,39] have all been appropriated to support religious practices. Scholarly evidence also shows that ICT adoption spans multiple countries (e.g., Kenya [38] and the U.S. [37]) and faiths (e.g., Islam [22], Judaism [8] and Wicca [7]). Reports also indicate that ICTs have been adopted to support dominant or state religious practices [7,39], and used to practice forbidden faiths [17]. Given HCI's interest in the human-centered design of technologies, it would be peculiar not to study this worldwide phenomenon. Further, other research shows that religion affects topics receiving increased attention from the HCI community, such as disaster response, healthcare, and sustainability [39].

This evidence raises an important question: what should HCI do with respect to this trend? It is a complex proposition for researchers or practitioners in the community to design religious applications, particularly in societal contexts where faith and work have been separated. But, we suggest an alternate reason to explore techno-spiritual practices. Specifically, we use religion and faith as lenses to examine the assumptions and values that shape future domestic environments. To do this we studied how American Christian laity use technology at home to support their faith. While reports find increased use of ICTs for religious purposes, little is known about the specifics of how and why Protestants (e.g., Baptists, Methodists, and Presbyterians) use ICTs at home [19,33]. Our goal is to use our study's results to offer an alternative perspective on a

central HCI design agenda, the creation of domestic applications.

In this paper, we make two contributions for the HCI community. First, we provide empirical evidence demonstrating how topics of interest to HCI researchers (e.g., material artifacts, routines, and ICTs) are used for religious purposes. Our findings show how Christians distinguish artifacts, routines, and ICT use related to their religious and faith-related practices from their secular counterparts. Second, we use our findings to reflect on current directions of future domestic ICT applications. Specifically, we compare the "problem solving" approaches that we see dominating the design of future domestic technologies and present *extraordinary computing* or systems that recognize, support, and honor meaningful aspects in users' domestic lives.

This paper is organized as follows. We begin by reviewing related work that examines the use of ICTs for religious purposes and the empirical results of HCI research in the home. Next, we describe our study methods and participants. We present our findings organized around three themes: material artifacts, routines, and ICT use. We then turn to a discussion of how our results provide an opportunity to reflect on the themes that dominate technology design. In the discussion, we elaborate on extraordinary computing and describe three overlapping characteristics associated with it: reflection, temporality, and being enduring. Accompanying each characteristic are thoughts about how to incorporate them into future domestic environments and applications.

Before turning to the related work, we explain what we mean by religion and faith. We define faith as an individual's expression of his or her religious beliefs and religion as the formalized expression of a larger faith community. We use these terms to characterize what we examined in our study of American Protestant Christians.

RELATED WORK

ICTs and Religion

It is not surprising that the study of the religious uses of ICTs has a long history, given the importance of religion in scholarly study. As ICTs have become increasingly widespread, so have studies examining how they support religious practices. In this section, we provide an overview of this research grouped into three areas: religion online, design explorations, and studies of appropriation.

Religion Online. The rapid adoption of the Internet in the 1990s gave rise to a significant body of scholarly research focused on understanding religious practice online [7,13]. For example, research has shown how different religious groups have adopted email for community coordination [7,39], used websites to read religious materials, observe rituals, and download services [7,13,17,33]. It also shows that while the Internet can allow adherents of less practiced religions to find critical mass, simultaneously it can raise questions about control of doctrine and interaction for faiths with many practitioners [7].

Our research builds on these and other studies. Their results guided our study design by providing us with topics to ask questions about during our interviews. However, we started from a different perspective inspired by research that argues the virtual is always grounded in people's lived experiences [23]. So, rather than beginning with their online experiences, we sought to complement this research by starting in our participants' homes to learn how their offline faith took them online.

Design explorations. A second body of research has focused on design. Within HCI, examples include AltarNation, a system that allows physically isolated individuals to collectively pray [18], and Gospel Spectrum, a Bible visualization system [12]. Other research has focused on design sketching to explore questions about the religious appropriation of ICTs [38]. Outside of HCI, designers have created artifacts that explore what it means to mix technology and religion, or comment on faith and material culture [1]. This research inspired us to think of ICTs as products, but also as occasions to collect data about religious uses of ICTs.

Studies of technological appropriation. HCI researchers have recently explored the appropriation of technologies by different religious communities. Wyche et al. [39] studied Christian ministers in the Southeastern United States (U.S.), to identify how they as leaders and decision-makers appropriated ICTs for administrative and spiritual purposes. Others have focused on understanding how ICTs support religious practices, such as technologies in support of Sabbath day [37], and in Asian family life [2].

We extend this research using similar methods and theoretical approaches in our study design and analysis. However, we wanted to turn our attention to American Protestant Christians' homes. We chose this group because research shows they are often associated with churches that are perceived to be leaders in ICT adoption, megachurches. Megachurches are typically defined as those with 2000 or more regular attendees, often emphasize rapid congregational growth, and their laity tend to be evangelical [19,33,39]. This is not to say that believers of other faiths are not using technologies, only that evidence exists that the uptake has been particularly rapid and extensive among American Protestant Christians. This would give us the most opportunities to observe ICT appropriation.

We also focused on this group because of their ubiquity, particularly in the U.S. Reports suggest that over 80% of the country's population identifies as Christian, with a majority being Protestant [31]. Indeed, in the U.S. it could be argued that they are likely to live in the homes that are the target of technological domestic interventions. Christians are likely to be participants in our studies, potentially trial users of new systems. Focusing on Protestant Christians supports our goal of complementing

domestic HCI research by providing an alternative perspective of home life, one that includes an emphasis on how the same secular ICTs are incorporated (and not incorporated) into religious and faith-related practices.

HCI and the Home

HCI researchers continue to conduct studies aimed at providing the community with a more detailed understanding of domestic life [9,11,21,24,26-28,30,34]. Prior research paints a rich picture of secular home life. Yet, church leaders and laity view the home as important place for religious practice. In this section, we focus on three well-established themes in HCI research, that we will re-examine in our findings from the perspective of religion: material artifacts, routines, and ICT use.

Material artifacts. Researchers have explored how material artifacts such as lists, calendars, clutter and refrigerator doors support domestic social arrangements [9,24,27,30]. Consistent among this research is the repeated characterization of domestic artifacts and the activities they support as "ordinary" and "everyday." The everyday theme appears to lead to a characterization of the home, and the activities that take place in it, as lacking qualities that set them apart from others. Some research does highlight how domestic artifacts have personal significance (e.g., family photos, and children's drawings) [27,30]. However, that meaning has stemmed from other forms of attachment, and religion offers an alternate perspective on why particular items become and remain important to householders. Further, these prior characterizations potentially marginalize the complex values (e.g., those related to individuals' spiritual beliefs) underlying users' interactions with material artifacts.

Routines. The focus on routines in the home yields a similar secular characterization [9,34]. Routines are an important aspect of home life because they are the "glue of domestic life" (central to household coordination) and can highlight "prime sites" for new ICTs in the home [9]. Domestic routines have a less goal-oriented nature than their workplace counterparts, leading some to suggest that they are "taken for granted" [34]. Indeed, asking participants to recount these activities has been described as a challenging by researchers studying the home [5]. Tolmie et al. [34] remark on this, and further suggest that because routines are so unremarkable they merit computer applications that are equally unremarkable or "invisible." While we agree that domestic routines are important, we contend that practices interwoven with religion take on a different type of meaning than ones examined in prior HCI research. Seeing routines as having a religious or ritual meaning offers a different perspective on domesticity.

ICT use. The use of ICTs in the home was the original focus of domestic HCI research. The HomeNet project focused on identifying the occasions for and types of Internet use in the home [21]. Over time this has been complemented by studies of newer ICTs finding their place in domestic routines such as laptops [36], mobile phones [26], and ultra mobile devices [28]. Research has also sought to understand what the Internet is used for and which applications drive ICT use [20]. This research has been complemented by studies of religious Internet use [7,19], but in these latter studies it remains unclear whether participants engage in these practices from their home, and usage is not situated with respect to the domestic environment where it takes place. Our research closes this gap by showing how Christians use ICTs in their homes.

STUDY: METHODS AND PARTICIPANTS

We used a combination of semi-structured interviews and in-home tours during this project. Semi-structured interviews were chosen so we could balance questions that came out of the related work with our desire to learn about what might be particular to Christian practice in U.S. homes. This semi-structured approach had another valuable outcome: it helped us develop rapport. We felt this connection would have been more difficult to achieve had we conducted structured interviews. Given that we were asking questions about personal religious practices, we wanted to ensure that people felt comfortable with us. Thoughtfully listening and encouraging our participants to elaborate on their responses helped them more openly discuss their faith.

We were guided by Blythe et al.'s [5] "technology biographies" during the home tours. This involved asking participants to take us on tours of their homes, asking them questions about technology usage, and the history of the items that we saw. We scoped this approach by focusing questions about religious and faith-related ICT use (e.g., When was the last time you used your computer for religious reasons?; Tell me about your church and online prayer requests.). Our tours were broadened in other ways because we were interested in seeing not just ICTs but other artifacts that potentially pertained to domestic religious practices. In other words, we also inquired about artifacts such as chairs, tables, refrigerators, to explore if they played a role in participants' faith-related practices.

All sessions lasted between one and one-and-a-half hours. We interviewed 20 individuals (15 women and 5 men) at 20 different homes. All lived in the greater metropolitan Atlanta-area and ranged in age from 21–68 years old, with the median age being 35. Participants had various occupations including student, nutritionist, loan underwriter, and teacher. We recruited evangelical Protestant Christians following reports suggesting that they have adopted ICTs extensively, since we hoped that it would yield the most usage information [19,33,39]. Of our participants, eight described themselves as "born again" (having discovered or renewed a commitment to Jesus as one's personal savior), and the remainder used their denomination to characterize themselves (e.g., Southern Baptist). All participants reported going to church at least once a month with 15 attending weekly. Laity were

Figure 1. Artifacts used to support participants' faith.

recruited via word of mouth, flyers, and Internet-based classified advertisements.

We stopped conducting interviews once we reached saturation [15]. Our data set included 450 pages of transcribed interviews, approximately 100 photographs were taken during our home tours, and we generated 50 pages of field notes. Supplementing these were memos documenting the researchers' more introspective thoughts and reflections about the themes emerging in the data. The constant comparative method [15] guided our data analysis in conjunction with reading social science and HCI literature.

FINDINGS

We present our findings organized around the themes of material artifacts, routines, and ICT use. Broadly, our findings demonstrate that Christians distinguish religious and faith-related artifacts, routines, and ICT use from their secular counterparts.

Material Artifacts

During our home tours, we encountered faith-related material artifacts such as crosses, plaques with Biblical messages, and copies of the Ten Commandments (Figure 1). When we asked participants about these artifacts, many said they helped them stay mindful of their faith. For example:

> I see [the notes] every morning. They always remind me of my faith. You know, like I said "out of sight, out of mind?"

Upon further probing, participants articulated three ways faith-related artifacts differed from secular ones. First, they did not easily discard artifacts that they saw as connected to their faith. Second, they spoke about how these material artifacts reminded them of goals that transcended their everyday lives, and consequently were opportunities for reflection. Third, we saw and learned how these artifacts were coupled to the use of space. In particular, we saw artifacts helping our participants carve out spiritual spaces to practice their religion at home.

Temporality of Material Artifacts: In all of our participants' homes, we saw artifacts that reflected their Christian identities. In fact, we sometimes saw these artifacts before we entered their homes, such as the yard sign with the Ten Commandments on it (Figure 1, left). These artifacts were manufactured, such as the plaque that contained a religious message in one participant's home (Figure 1, right). But the people that we interviewed created others.

For example, we saw faith-oriented notes on refrigerators. Indeed, we were struck by how common an occurrence this was in the homes we toured. These notes existed alongside typical notes that have been reported in other research, those in service of daily routines such as grocery lists, to-do lists, and calendars. The refrigerator became an important and useful place for us to explore the differences between the secular and religious handmade artifacts that we saw.

When asked about these notes, participants frequently talked about differences in temporality. They described removing secular notes from refrigerators and discarding them once the activity (e.g., buying groceries or attending a dentist appointment) was completed. Religious notes also served in this reminding capacity, but did not have the short-lived life of their secular counterparts. What they reminded our participants of took longer to reflect upon and was related to their larger goal of living a life in accordance with their Christian faith. This participant's response, like many we heard, illustrates the temporality of notes:

> Yeah, well – I'll change the verse every other two or three months. I have a new one now, and it is about forgiveness, but I like to keep them up there for a while.

Some material artifacts had extremely long lifetimes, longer than their current owners did. For example, participants kept their own Bibles and those handed down to them from their ancestors. Ancestral Bibles, those much older than our participants, showed us how religion coupled with family history produces material artifacts with powerful archival attachment. Participants were also attached to their personal study Bibles; this was frequently not the family historical Bible. Their attachment stemmed not just from the fact that it is the Christian faith's central text, but because their copies were often hand-annotated with notes describing passages of particular personal meaning, and interpretative commentary [10,38].

Some participants developed a similar attachment to their electronic Bibles. One of our older participants showed us her 20-year-old digital Bible that she would not part with because of its importance in helping her "grow in her faith" (Figure 2). While we are some way from digital objects having antique status, it is not the clear that the practices around ICT development promote artifact preservation. Indeed, others have argued that upgrades suggest regular discarding, a much more transient relationship with technology [4].

Figure 2. Participant's Digital Bible.

Reflecting on the Extraordinary: A strong theme across the material artifacts we encountered was their role in helping participants reflect on their faith. Some participants characterized this as using these artifacts as reminders to set aside thoughts of the ordinary and focus on the "extraordinary," or their relationship with the divine. Having the notes in place helped them to retain this focus on their faith. As one young man explained:

> [The notes] always remind me… Like a lot of times I should be working for the Lord, rather than other people. And then I always try to remember that I'm working really hard, doing certain things, and people may not appreciate it, and I may get upset, I take a look at those and remember it doesn't matter what they think – it matters what the Lord thinks.

We saw examples of religious artifacts that were obviously connected to participants' faith. For example, pictures and physical crosses were present in homes. Texts drawn from the Bible also highlighted that a particular artifact was religious in nature. However, we saw other artifacts that initially did not imply religion, even though our participants used them for faith-related purposes. For example, we frequently encountered scenes from nature, flowers, sunrises, and so forth. Our participants told us that those images reminded them how their faith included the creation of these phenomena. These beliefs extended to their online experiences, with screen savers and backgrounds having important religious significance.

Establishing Spiritual Spaces: Artifacts also helped our participants establish spiritual spaces within their homes. Similar to how postal mail is displayed in specific areas to support the routine of opening it [9], paper Bibles were placed in designated areas to support daily reading. Rather than finding Bibles in "high traffic areas" such as living rooms or kitchens, we frequently saw them in bedrooms, and other "low traffic" domestic areas. Bedrooms, by their property of being a private space in most American homes, were ideal places for our participants to intimately concentrate on their faith. This separation was a consistent theme that we heard from our participants, and contrasts with HCI research that has shown how artifacts support familial collaboration and coordination. In this case, artifacts were placed in spaces where their use would imply being set apart from the rest of the household.

Although we frequently saw Bibles serving this role, we also encountered other artifacts serving a similar purpose. One particularly unusual example of this was a woman's "prayer chair" the use of which she described:

> Here this is where I read the things that I print off downstairs [in her computer room]. For instance, this is a twenty-eight day prayer guideline, sent by my church, that I am going to use… I print it off my computer, and I come up here to my cozy, little, private spot. This is my prayer chair, I'll print [prayer requests], and I'll take it up to my prayer chair and present it to the Lord several times over the week.

Her description of the chair as "private" highlights how it, and the bedroom in which it resides, differs from the computer room in her home's basement. Her routine of receiving prayer requests at her computer, then printing them out, bringing them to the prayer chair, and then "presenting" them, represent a process of engaging with the divine about these requests. What we learned from this participant was that spaces in her home are not equivalent for religious purposes. The computer was not located in an appropriate setting for her faith-related practices, but it was implicated in those rituals. Thus, using printouts, she moved the prayers from an inappropriate to an appropriate place in her home. This mirrors research in HCI that has focused on understanding the interaction between ICT use and domestic space, but again we see a narrative of separation, taking online materials offline and bringing them to a space removed from the home, a private, reflective space for use.

Routines

Like material artifacts, we observed similar ways participants distinguished faith-related routines from secular ones. We now discuss the differences our participants described to us. The most important and constant theme was the temporal rhythms of religiously grounded routines, frequently based on the religious calendar [40]. In summary, the most important difference between the religious routines that we heard about, and those routines we read about most frequently in HCI literature, was an explicit emphasis on the difference in routine created by religion.

Daily: All participants had daily faith-related routines. Practicing these routines was an essential part of sustaining their relationship with the divine, and not making time for these activities was considered problematic. Participants worked to balance these routines with secular ones:

> I wake up and I'll study Scripture from 6 to 7. And then I'll go about my daily routine. My goal is to have at least one hour of reading Scripture or prayer everyday. But where I fit that in …

Most commonly, we found that people made time for religious practice at the end of the day, before going to bed.

Weekly: Participants also spoke to us about routines that happened on a weekly basis. One routine that we encountered was to leave one's house, and enter another's home for religious practice. This was frequently motivated by the desire to participate in a community of practice:

> I go to Bible study to get to know others, to get connected, and to be with people who uphold each other spiritually in our daily lives. It's hard, you know, to have that as your lifestyle – to really walk, a mature, Christian life.

Community practice plays a central role in the Christian religion. Indeed, clergy frequently describe physical community's significance to argue against Internet-based forms of communal worship [39]. And while that always means attending church on Sunday, it also means meeting in smaller groups to study the Bible outside of church. This

is particularly true for megachurch attendees. Megachurch clergy promote Bible study (and other small group activities) to create community in their large congregations.

This participant's Bible study, like most, took place in another home, and the event was frequently coordinated using email. So, ICTs were not only being implicated in within home routines of religious practice, but in cross-household routines. These cross-household routines are reported in prior HCI research, but the ones that have occupied most attention are those that connect families, perhaps in the provision of healthcare or in general family maintenance. For more than half of our participants the connection to other laity was the focus of their cross-household interactions rather than the connection to their extended family. Religion offers a different perspective on who is connected to whom in inter-household networks.

Going to church on Sunday mornings was also an important routine for our participants. Sunday has long been set aside as the most important day of the week for Christians, and our participants took it very seriously:

> Well, I worship every Sunday morning, this has been a lifelong habit, I could count on one hand the number of times I haven't been to church on a Sunday morning during my life.

Not only did they describe it as commitment, but also as a special feeling that the day gave them:

> When I wake up on Sunday morning, like, I wake up in the morning, um, you know, it's like faith got me, and I wake up and get ready for church.

This feeling permeated other routines. For example, we heard how people dressed differently (e.g., some female participants wore special hats on Sunday), traveled to church as a family, and woke up at a different time. Others told us how they placed their Bibles near their front doors on Saturday night, so they would remember to take them to church the following morning. For all our participants, Sunday changed routines, and what they did became a reflection of the day's significance to them. In other words, Sunday was not everyday, it was set apart and honored.

Yearly: We also heard how these changes extended to annual religious celebrations. The two we most frequently discussed were Christmas and Easter (celebrating Jesus Christ's birth and resurrection respectively). Participants talked about making time for religious practices and enacting particular rituals for these special occasions. For example, participants described bringing an evergreen tree into the home and decorating it during Christmas. Other examples included dressing and eating differently, having extended family stay, and taking time away from work.

Daily, weekly, and annually, religion creates special rhythms within our participants' routines. These rhythms had their own constancy, so in a sense religion routinely changed routines. We want to make clear that across all of these routine changes was a sense of the practices' significance or an elevation from the sense that it was "ordinary" (even if it was routine) to being something done in response to a system of beliefs grounded in the extraordinary or divine. These changes were celebratory, and as others have argued such routines are neglected from current HCI design discourse [16].

ICT use

In this section, we concentrate on how participants distinguished religious from secular ICT use. Participants described using email differently in two ways: changing their conversational "tone" and expecting different responses. They also used ICTs to project a Christian identity. Finally, we learned about the variety of ICT-based religious practices participants engaged in at home.

Email: Wyche et al.'s [39] study of Protestant Christian ministers suggested that church leaders perceived that their laity used email for faith-related purposes. Our research confirms this assumption. All our participants made use of email for coordinating religious events like Bible study, receiving daily devotionals, and engaging in online discussions about faith. But prayer requests were the most prominent use of email.

Church members either sent prayer requests (asking people to remember others in need of spiritual guidance, healing or emotional support) either directly to laity or to congregational mailing lists. All participants reported sending and receiving one or two requests a week. Three told us they received 10-12 requests per day. Regardless of number, all participants distinguished these emails from secular ones, noting their significance, and how they were embedded into other routines involving other material artifacts in the home, such as the prayer chair described earlier. For example:

> The [emails] that are prayer requests are coming in as encouragement sometimes, those are, you know, those are very personal emails… Versus work, "Ok you need to get this done" It's just work, you know?

Previous research on email has shown that it motivates people to connect to the Internet because of its conversational nature [20]. Because email typically warrants replies, it engages people to want to log-on. Therefore, we asked participants about prayer request emails, and how they knew a request had been received or answered. Unlike other emails, few expected a digital reply to their prayer requests, instead telling us that the reply came in an entirely different form as these two quotes illustrate:

> I believe that my prayers send those invisible guardian angels, and God honors it. But can I prove that? The only way… Who would know? No one will ever know, until we get to Heaven… I have no evidence.

> Some people will tell you "you know, I really felt like someone was praying for me today." It's really hard to describe, but it is not like you get an email you notifying you when it has been answered (laughter), it is a feeling.

Online electronic prayer request exchanges have a one-way character. However, as these participants explained, it is only by accounting for the offline that the reciprocal nature of the exchange can be fully understood.

Participants also frequently described changing their conversational "tone" when they used email for religious purposes. In many cases, this meant being more thoughtful and taking more time when writing a faith-related message. For example:

> There's definitely a difference in tone. Administrative email is usually for an organizational thing. It's usually very lighthearted, very short. A [faith-related] email, I spend a lot of time writing. It's really a much more deep thing. You really get into it. It's sharing your faith, it's debating something that's central to your life. It's more important.

It is unlikely that religion is the sole reason for this change in tone. Rather we see it as being a question of prioritization. For our participants, their faith was a means of making decisions about what was the most important email to deal with or devote time to. It highlighted how domestic email was not just "non-work" email, but also a medium appropriated in rich, different ways, depending on the context and purpose of its use.

Identity Expression and Recruitment: A variety of ICTs helped our participants communicate their Christian identity. For example, participants included Biblical quotes in their signature files:

> I have a verse on my emails like a message and stuff, I put a few Scriptures up there. Depending on how I'm feeling, like there might be scriptures of encouragement or scripture describing who God is. Or just something I really liked and wanted everyone else to know about.

Others described leaving faith-related outgoing messages on their phones. For example:

> It's long [the message] but you would be amazed. I have bill collectors, preachers, friends that tell me they received so much encouragement from my outgoing messages.

These quotes demonstrate that some of our participants use these mediums to evangelize, or spread their faith. These actions were not just an expression of their own values, but also something that they wanted others to know about them and they also hoped would reach an audience. This is not surprising since many of our participants were Evangelical Christians, but it does speak to the on-going use of ICTs to spread the faith and recruit new participants.

This use of ICTs highlights a dilemma: some uses of ICTs create complex value interactions between researchers, designers and users. Of course this has always been the case, but we see this dilemma as not only persisting, but also increasing as HCI moves into contexts where different value systems prevail. For example, as HCI4D takes HCI researchers to countries and cultures where religion has a very central and public role in daily life, so the nature of what constitutes appropriate ICT design will likely include

faith-related applications. The question of whose values are embedded into the artifacts we design or the data that we report is a central challenge facing the community [35]. One way that these value interactions manifest and can be considered is through the studying religion.

Other Religious ICT Uses: Half of our participants reported watching sermons online. They liked being able to watch sermons online at an appropriate time for them rather than when they were broadcast on television. This desire, we learned, speaks to the importance of balancing time for religious viewing against competing uses of the computer within households. In addition to watching sermons from their own church, participants watched ministers' sermons at different churches. Some reported watching sermons from around the world, thus connecting their local religious community to a global one.

Two participants used Voice over IP software (e.g., Skype) to pray with individuals living in other countries. Again, like sermon watching, people were using ICTs to make connections to a global community of faith. But our participants also made local connections. Participants told us how they sent text messages drawn from the Bible to friends from their church and family (a practice also observed in Kenya [38]). These shared conventions suggest that some local techno-spiritual practices may have a global ubiquity.

We also found some concerns about using technologies for religious purposes. In addition to economic costs associated with ICT use, five participants commented on the difficulty of knowing whether WWW resources provided reliable and accurate information. For example:

> It kind of confuses people and, you know, you are trying to learn about Christianity and find something you never heard of, like, there was a site saying Jesus has a baby!

Online religious investigations are subject to questions about data veracity similar to health-related uses of ICTs. Interestingly, we did not hear about uses that were ruled out for reasons of doctrine or rules set by religious leaders. Such cases have been reported among other faith groups, such as the Amish and in some Orthodox Jewish communities [8].

DISCUSSION: MOVING TOWARDS EXTRAORDINARY COMPUTING

Our findings demonstrate that Christians distinguish faith-related artifacts, routines, and ICT use from those lacking religious and faith-related meaning and value. Though our results are not exhaustive in describing everything personally significant to our participants, they are useful for understanding how religion provides an alternative perspective on popular themes in domestic HCI research. In this discussion, we elaborate on extraordinary computing and describe its three overlapping characteristics: reflection, temporality, and being enduring. Accompanying each characteristic are thoughts about how designers might begin to account for them in future domestic environments.

Extraordinary Computing: Our findings suggest opportunities for *extraordinary computing* or systems that recognize, support, and honor meaningful aspects in users' domestic lives. This term contrasts ordinary technologies that tend to focus on problem solving in the home and arguably overlook aspects of users' lives that are laden with religious and other types of personal meanings. Extraordinary computing is closely related to Grimes and Harper's [16] idea of "celebratory technologies," an argument for the consideration of successful food practices rather than the typical design approaches that view ICTs as correcting eating problems. What is common between extraordinary and celebratory technologies is the focus on designing ICTs that do not try to find and fix problems, but rather approaching design as a process of making ICTs that allow people to separate the special from the ordinary. However, unlike celebratory technologies, our approach also accounts for the quiet, intimate, reflection associated with religion that seems harder to reconcile with the sociality of celebrations [16]. Next, we further explain extraordinary computing and describe how existing domestic technologies can integrate its characteristics.

Reflection: Examining religion in domestic life revealed the personal meaning participants gave to different times of the day, week, and year. These rhythms prompted us to question a dominant theme in HCI, and particularly Ubiquitous Computing research: the smart home. Visions of smart homes frequently articulate problems to be solved; such as using sensors to help detect whether people are moving enough or monitoring the elderly [29]. While we support that agenda, our focus on Christians' faith gave us insights into other aspects of home life, ones that current technologies do not readily account for, reflection, or our participants' desires to reminisce and focus on their inner thoughts. We saw this manifest in material artifacts used to support participant's connection to the divine and in their desire to set aside certain times of the day and week to focus on studying the Bible.

Digital picture frames already embody some reflective qualities. For example, they symbolically remind individuals of memories attached to a visit to a place, or a relationship, so they can remember these experiences. From our research, we are certain that religious people will use these devices to similarly support reflection on their faith. There are additional ways digital picture frames and other ambient displays can support reflection. We found that our participants were not interested in receiving feedback after sending electronic prayer requests (e.g., Was the prayer request about my friends' job interview answered?). Instead, they found comfort in knowing people were praying for them. In addition to displaying meaningful imagery, digital picture frames could have an added feature that visualizes religious individuals sending and receiving prayers. We envision subtle bursts of light complementing the digital picture indicating the transmission of a prayer request. We see similarities between this function and the

virtual "poke" interaction found on facebook.com, the popular social networking site. In both cases, ICTs prompt users to reflect on the action's meaning.

Focusing on existing domestic technologies prompted us to explore how to incorporate reflective elements into other ICTs, take traditional calendaring systems. In HCI we have tended to prioritize calendar's coordinating functions, while overlooking their other purposes [9,24]. Paper calendars typically contain images, often designed to appeal to individuals' tastes to sell calendars. In other words, paper calendars embody aspects of life that are not ordinary, but are set apart from life's more practical activities. Additionally, paper calendars remind us of personally significant events such as anniversaries, religious holidays, and birthdays. Prior HCI research has overlooked these latter aspects of calendaring systems. Future systems should account for both of these qualities. For example, domestic displays could celebrate significant dates by automatically changing their interfaces to reflect those occasions (similar to how Google's home page reflects different holidays). This would have the additional benefit of providing religious individuals with another way to use ICTs to support their religious identity, a desire that emerged from our study. Whether its religion or something else, our point is that calendars can and do support identity projection and highlight the special.

Finally, examining religion highlighted where reflective moments take place in the home. Participants used artifacts to establish boundaries within their homes to create spaces where they could quietly pray or study Biblical scriptures [25]. Many of our participants used their bedrooms for this activity, a domestic space that has been overlooked as a site for ICT innovation. This poses interesting questions. Should technology enter these spaces that some might like to remain technology-free? Do we introduce technologies to support intimate religious practices? Grimes and Harper [16] note that celebratory technologies pose a similar dilemma for designers. On one hand, we imagine that extraordinary systems could potentially serve in the same capacity as Bibles and allow users to demark particular domestic zones for introspective and solitary activities. On the other, it is not clear whether ICTs have a role in the most reflective of activities—for example, our participant who printed out her prayers and took them to her chair. The introduction of these systems, like celebratory technologies, needs to be carefully managed.

Temporality: A second characteristic associated with extraordinary computing is temporality, or imagining new ways systems present time. This was another strong theme in our findings. We identified a way that ordinary applications can account for this temporality. Again, we examine this within calendaring systems. Our findings make clear that people associated different days with different meanings (e.g., Sunday is set apart from other days of the week). This status as it turns out was largely rewarded in the digital calendars we saw that typically

placed Sunday at the beginning or end of the week, potentially setting it somewhat apart from other days. However, different faiths prioritize different days, for example, the Jewish Shabbat is observed from sundown on Friday until Saturday evening. Thus, we suggest that calendaring applications support customization so that people can separate and promote the days of their choice, or set apart those that have more significance than others do.

Enduring: The final characteristic of extraordinary computing is being long lasting or enduring. This manifested in participants' relationships with material artifacts that had religious value. For example, we were struck by how some participants were reluctant to discard faith-related artifacts (e.g., Bibles and notes on their refrigerators). This desire was most pronounced with the participant who showed us her 20-year-old digital Bible, the one that she would not part with because of its significance to her (Figure 2). Compare that with advertising that encourages us to upgrade hardware in order to take advantage of next generation services. Some extraordinary computing devices might capitalize of what it means to get people to imbue digital objects with added value and significance so they become heirlooms [4], or have added personal meaning that goes beyond their functionality.

Mobile phones developed for the Orthodox Jewish community provide an example of how existing ICTs can take on enduring meaning in users' lives. In 2006, an Israeli wireless company developed a mobile phone specifically for the country's ultra-Orthodox Jewish community [8]. This "kosher" (meaning approved under rabbinical law) phone was a modified mobile phone with disabled Internet access, SMS text messaging, video, and voice mail applications. These changes were made to appeal to the community's desire to restrict access to dubious and unmonitored secular content. Most important to our discussion, these phones were visibly marked with a stamp signifying a rabbinical authority had approved the phone. These marks, and the ritual it represents, illustrate how enduring qualities can be embedded in ICTs. Note that the ritual does not have to be directly tied to religion. Indeed, we imagine other processes, such as inheritance, or being a part of a collection, as also contributing to an object's significance. In the future, we plan to investigate whether users are less likely to dispose of ICTs imbued with personal meaning. We believe doing so will contribute to the HCI community's interest in developing sustainable domestic technologies [4].

CONCLUSION

Studying and designing for religious uses of ICTs highlights thorny and complicated questions for the HCI community. Yet as researchers, we must understand the full range of ways people use ICTs to support everyday activities. Thus, we have presented findings from a study of the religious uses of ICTs in 20 American Protestant Christians' homes. The goal of our work was to explore religion as a lens through which to examine popular themes in domestic HCI research. We contribute to the empirical HCI literature by highlighting how faith affects sites of interest to ICT developers and researchers. Religious material artifacts had different temporal properties (tied to long-life and open-endedness), evoked reflection about life-goals, and helped carve out spaces for religious practice in the home. Everyday routines were transformed by daily, weekly, and yearly religious rhythms. Finally, using ICTs for religious purposes changed not just the dynamics of how a particular medium was used, but also gave rise to means to express and recruit, as well as connect to local and global faith communities. Further, we highlight how religion complements previous domestic HCI research by presenting an alternate perspective on domestic life we call extraordinary computing. We present characteristics that define this and explore how future domestic environments can account for and support some of the most personally meaningful aspects of users' lives. We believe investigating religious uses of ICTs will become more necessary as HCI developers continue to examine the assumptions that shape future technology development in the U.S. and elsewhere.

REFERENCES
1. "Design and Religion: New Forms of Faith" (special issue), *I.D. Magazine*, March/April, 2006.

2. Bell, G., "No More SMS from Jesus: Ubicomp, Religion and Techno-spiritual Practices," *Proc. Ubicomp 2006, Springer* (2006), 141-158.

3. Berger, P.L., *The Sacred Canopy*. Anchor Books, Garden City, NY, 1967.

4. Blevis, E., "Sustainable interaction design: invention & disposal, renewal & reuse," *Proc. CHI 2007*, ACM (2007), 503-512.

5. Blythe, M., Monk, A. and Park, J., "Technology biographies: field study techniques for home use product development," *Extended Abstracts, CHI 2002*, ACM (2002), 658-659.

6. Bruce, S., *Pray TV: Televangelism in America. Routledge*, London, England, 1990.

7. Campbell, H., *Exploring Religious Community Online: We are One in the Network*. Peter Lang Publishing, New York, NY, 2005.

8. Campbell, H., "'What Hath Got Wrought?' Considering How Religious Communities Culture (or Kosher) the Cell Phone," *Continuum: Journal of Media & Cultural Studies 21,* 2 (2007), 191-203.

9. Crabtree, A., Rodden, T., Hemmings, T. and Benford, S., "Finding a Place for Ubicomp in the Home," *Proc. of Ubicomp 2003*, Springer (2003), 208-226.

10. Csikszentmihalyi, M. and Rochberg-Halton, E., *The Meaning of Things: Domestic Symbols and the Self.* Cambridge University Press, 1981.

11. Cummings, J.N. and Kraut, R., "Domesticating Computers and the Internet," *The Information Society* 18, 3 (2002), 221-232.

12. Dang, A., "Gospel Spectrum," Proc. DUX 2005, AIGA (2005), poster.

13. Dawson, L.L. and Cowan, D. (eds.), *Religion Online: Finding Faith on the Internet.* Routledge Press, New York, NY, 2004.

14. Fischer, C.S., *American Calling: A Social History of the Telephone to 1940.* University of California Press, Berkeley, CA, 1992.

15. Glasser, B.G. and Strauss, A.L., *The discovery of grounded theory: Strategy for qualitative research.* Aldine Publishing Company, Hawthorne, NY, 1967.

16. Grimes, A. and Harper, R., "Celebratory Technology: New Directions for Food Research in HCI," *Proc. CHI 2008*, ACM (2008), 467-476.

17. Helland, C., "Diaspora on the Electronic Frontier: Developing Virtual Connections with Sacred Homelands," *Journal of Computer-Mediated Communication 12*, 3 (2007).

18. Hlubinka, M., Beaudin, J., Tapia, E.M. and An, J.S., "AltarNation: Interface Design for Meditative Communities," *Extended Abstracts, CHI 2005*, ACM (2002), 612-613.

19. Hoover, S.M., Clark, L.S. and Rainie, L. Faith Online: *64% of wired Americans have used the Internet for spiritual or religious purposes*, Pew Internet & American Life, Washington, DC, 2004.

20. Kraut, R., Mukhopadhyay, T., Szczypula, J., Kiesler, S. and Scherlis, W., "Information and Communication: Alternative Uses of the Internet in Households," *Information Systems Research 10*, 4 (1999), 287-303.

21. Kraut, R., Scherlis, W., Mukkopadhyay, T., Manning, J. and Kiesler, S., "The HomeNet Field Trial of Residential Internet Services," *CACM 39*, 12 (1996), 55-65.

22. Lee, T.S., "Technology and the Production of Islamic Space: The Call to Prayer in Singapore," *Ethnomusicology 43*, 1 (1999), 86-100.

23. Miller, D. and Slater, D., *The Internet: An Ethnographic Approach*. Berg, Oxford, England, 2000.

24. Palen, L. and Aaløkke , S., "Of Pill Boxes and Piano Benches: "Home-Made" Methods for Managing Medication," *Proc. CSCW 2006*, ACM (2006), 79-88.

25. Palen, L. and Dourish, P., "Unpacking "Privacy" for a Networked World," *Proc. CHI 2003*, ACM (2003), 129-136.

26. Palen, L. and Hughes, A., "When Home Base is not a Place: Parents' Use of Mobile Telephones," *Personal and Ubiquitous Computing 11*, 5 (2007), 339-348.

27. Petrelli, D., Whittaker, S. and Brockmeier, J., "AutoTyopography: what can physical mementos tell us about digital memories?," *Proc. CHI 2008*, ACM Press (2008), 53-62.

28. Rattenbury, T., Nafus, D. and Anderson, K., "Plastic: A Metaphor for Integrated Technologies," *Proc. Ubicomp 2008*, Springer (2008).

29. Rowan, J. and Mynatt, E.D., "Digital Family Portrait Field Trial: Support for Aging in Place," *Proc. CHI 2005*, ACM (2005), 521-530.

30. Taylor, A.S., Harper, R., Swan, L., Izadi, S., Sellen, A. and Perry, M., "Homes that make us smart," *Personal and Ubiquitous Computing 11*, 5 (2007), 383-393.

31. The Association of Religion Data Archives, "National Profiles: The United States," http://www.thearda.com/internationalData/countries/Country_234_1.asp (2007).

32. The Encyclopædia Britannica, *Worldwide Adherents of All Religions*. Encyclopedia Britannica, 2005.

33. Thumma, S. and Travis, D., *Beyond Megachurch Myths: What We Can Learn from America's Largest Churches*. Jossey-Boss, San Francisco, CA, 2007.

34. Tolmie, P., Pycock, J., Diggins, T., MacLean, A. and Karsenty, A., "Unremarkable Computing," *Proc. CHI 2002*, ACM (2002), 399-406.

35. Winner, L., "Do Artifacts Have Politics?," *Daedalus 109*, 1 (1980), 121-136.

36. Woodruff, A., Anderson, K., Mainwaring, S.D. and Aipperspach, R., "Portable, But Not Mobile: A Study of Wireless Laptops in the Home," *Proc. Pervasive 2007*, Springer (2007), 216-233.

37. Woodruff, A., Augustin, S. and Foucault, B.E., "Sabbath Day Home Automation: `It's like mixing technology and religion'," *Proc. CHI 2007*, ACM (2007), 527-536.

38. Wyche, S.P., Aoki, P.M. and Grinter, R.E., "Re-Placing Faith: Reconsidering the Secular-Religious Use Divide in the United States and Kenya," *Proc. CHI 2008*, ACM (2008), 11-20.

39. Wyche, S.P., Hayes, G.R., Harvel, L.D. and Grinter, R.E., "Technology in Spiritual Formation: An Exploratory Study of Computer Mediated Religious Communications," *Proc. CSCW 2006*, ACM (2006), 199-208.

40. Zerubavel, E., *Hidden Rhythms: Schedules and Calendars in Social Life*. University of California Press, Berkeley, CA, 1981.