Alternative Pathways to Caring for Limits: The Case of Ecospirituality

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ABSTRACT

Research in Computing Within Limits and the broader Sustainable Human-Computer Interaction community has shown the need to understand the values beyond the scientific rationality that motivates people to care for ecological limits. This paper looks at the role of religion in orienting people towards a limits-aware perspective and a more sustainable living. We conducted interviews with individuals at various Catholic organizations working on promoting environmental sustainability within their respective contexts. We examined how a limits-aware perspective is embedded in the faith of our interviewees, which plays out practically in their everyday work and decision-making. We discuss digital technology's role in advancing care for limits by nurturing values embedded in religion supporting sustainability.

CCS CONCEPTS

• **Human-centered computing** → *Human computer interaction (HCI)*; Empirical studies in HCI;

KEYWORDS

HCI, religion, limits, sustainability, ecospirituality, Catholicism

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1 INTRODUCTION

> "Human beings and material objects no longer extend a friendly hand to one another; the relationship has become confrontational. This has made it easy to accept the idea of infinite or unlimited growth, which proves so attractive to economists, financiers and experts in technology. It is based on the lie that there is an infinite supply of the earth's goods, and this leads to the planet being squeezed dry beyond every limit."

This quote by Pope Francis in his encyclical *Laudato Si* [27] undeniably captures the idea that motivated the establishment of the Computing Within Limits (LIMITS) Community.

Since its first workshop in 2015, the community has made multiple calls to consider the sociocultural and psychological factors prompting care for ecological limits [18, 36, 50]. Knowles and Eriksson [50] argued that "without confronting the underlying psychology that perpetuates our current state of un-sustainability, there is little computing can hope to achieve." Similar attempts have been made in the broader Sustainable Human-Computer Interaction (SHCI) community over the years [15, 77]. This paper looks at religion as a crucial motivational factor to care for ecological limits. While data can help underscore the seriousness of various climate-related issues, substantial motivation is a moral imperative. Taking a cue from Rifat et al. [74], we investigate religion as an alternate not-necessarily-data-driven approach to sustainable behavior, understanding the role religion could play in promoting a limits-aware perspective.

Religion is uniquely positioned in comparison to other frameworks in that there is not necessarily an underlying need to present data as a catalyst for change [74]. Pope Francis writes in Laudato Si, "The creation accounts in the book of Genesis... suggest that human life is grounded in three fundamental and closely intertwined relationships: with God, with our neighbor and with the earth itself" [27]. Our study focuses particularly on Catholicism, a branch of Christianity practiced globally by around 1.3 billion people [80]. We assess how Catholic Ecospirituality is aligned with the values of the LIMITS community and how it provides a motivation that goes beyond the current ecological crisis. Ecospirituality connects the science of ecology to spirituality [1, 57]. Lincoln [57] defined Ecospirituality as "a manifestation of the spiritual connection between human beings and the environment." The concept sprung from a reaction to the West's focus on materialism, regarding the environment as a material resource with intrinsic value [21].

We ask: *how does the Catholic motivation to care for limits—Catholic Ecospirituality—differ from motivations grounded in the scientific understanding of ecological limits?* and *how does Catholic Ecospirituality manifest in practice, and how could technology support this manifestation?*

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We interviewed 14 US-based Catholic organizations and individuals on ways they followed to promote environmental sustainability. We investigate limits-aware perspectives embedded in the faith of our interviewees playing out in their everyday work and decision-making. We examine the conceptualization of ecological limits from a Catholic Ecospirituality perspective, noting that this perspective goes beyond the current environmental crisis. We analyze the alignment of Ecospirituality with the scientific rationality of climate change. We assess how technology supports or hinders the operationalization of Catholic Ecospirituality.

Our paper makes two primary contributions. It explores an alternate motivation for caring for limits and sustainability beyond the rational and scientific reasoning that the LIMITS and SHCI community have not substantially explored. The paper suggests technology design considerations for supporting sustainable living informed by Catholic Ecospirituality.

The structure of the paper is as follows. We first provide an overview of Catholic Ecospirituality. We then discuss related work on how HCI scholars, in general, and LIMITS scholars, in particular, have engaged with religion in technology design and use. We describe the methods we followed, including our study context, data collection process, and data analysis. We present our findings and then discuss the themes that emerged from our analysis.

2 ECOSPIRITUALITY

Ecospiritual values have always been part of the eastern, Indigenous, and native cultures. Indigenous Tongva scholar Charles Sepulveda [75] speaks to these values being present within groups Indigenous to Southern California: "The people from these tribal nations, although forever changed due to colonialism, continue to understand that their lands and waters are special gifts provided by the power of nature giving them spiritual strength, sustenance, purpose, and life." In the West, the ideas became popular through the theological idea that God created the world freely, and thereby it has an intrinsic value and is worthy of our respect and care [21].

To present the context of this paper, in this section, we briefly discuss the history of Catholic Ecospirituality. This information may be unfamiliar to many of our readers and will help interpret our findings. For readers not familiar with the terms used in Catholicism, we suggest referring to Table 1.

2.1 Catholicism and Ecospirituality

The Catholic Church[1] is an international organization presided over by the Pope. The Pope balances the needs and operate autonomy of local churches with the universal teachings of Catholicism. He is responsible for preaching on a variety of topics to over 1.2 billion Catholics worldwide and interpreting church teaching in light of debate. This preaching includes teaching on the environment and the moral obligation for Catholics to live sustainably [27].

While people might be most familiar with the teachings of Pope Francis (the current Pope), several popes before him have promoted sustainability [27]. For example, in 1970, Pope Paul VI [68] discussed the "ecological catastrophe under the effective explosion of industrial civilization" with the Food and Agriculture Organization of the United Nations. He argued for changing the way we live, emphasizing that "the most extraordinary scientific advances, the most amazing technical abilities, the most astonishing economic growth, unless they are accompanied by authentic social and moral progress, will definitively turn against man" [68]. In 1979, Saint John Paul II [67] in his encyclical Redemptor Hominis, stressed that "[human beings] see no other meaning in their natural environment than what serves for immediate use and consumption." He suggested bringing fundamental changes in our lifestyles, power structures that govern our societies, and our models of production and consumption [67]. In 2007, Pope Benedict XVI [10] proposed "eliminating the structural causes of the dysfunctions of the world economy and correcting models of growth which have proven incapable of ensuring respect for the environment."

In 2015, Pope Francis, in the encyclical *Laudato Si* [27] offered a comprehensive overview of sustainability as part of Catholic morality. The encyclical is a 200-page 'letter' that includes six chapters. Chapter one lays out the various ways the Earth is being degraded by modern human practice. The chapter discusses ways in which environmental degradation has an outsize impact on the poor and marginalized. Chapter two proposes Catholics to care for the environment—creation as it is called—using evidence from the bible and other Catholic teachings. Chapter three explicates ways in which human activities have caused the degradation. Chapters four to six suggest a way forward grounded in "integral ecology," i.e., the notion that "we are not faced with two separate crises, one environmental and the other social, but rather one complex crisis which is both social and environmental" [27].

In 2020, the Vatican released "Journeying Towards Care for Our Common Home," a five-year update to Laudato Si to suggest more actionable updates [2]. In fall 2021, the Church released the global web-based Laudato Si Action Platform [3]. This website invites Catholics from various religious congregations and Catholic educational institutions across the world to participate in a seven-year journey of reflection and action on environmental issues. The platform asks participants to look at their impact in seven focus areas: *response to the cry of the earth*, *response to the cry of the poor*, *ecological economics*, *adoptions of sustainable lifestyles*, *ecological education*, *ecological spirituality*, and *community resilience and empowerment*. The platform proposes that participants assess, reflect, and plan a seven-year action plan. The plan includes yearly check-ins and reflection on progress as well as (re)commitment to continued progress in the coming year.

The increasing focus on sustainability laid the foundation for Ecospirituality to become more integral to Catholicism. Ecospiritual thinking has now become essential to Christianity and its subdivisions. For example, Thomas Berry [11], a cultural historian, noted that Christians recognize a need for an Earth Ethic, as is evident from the formation of an association called "Sisters of Earth." The association consists of nuns and laywomen from diverse religious communities sharing concern for the ecological crises and working toward healing and restoring Earth [6].

3 RELATED WORK

In this section, we discuss how sustainability has been conceptualized by the LIMITS and the broader SHCI community. We then describe how HCI has engaged with spirituality and religion.

[1]Referred to as the Church from now on in the paper.

Meaning of Catholic terms	
Religious word	**Meaning**
Church	A building used for public Christian worship; the Christian religious community as a whole; a body or organization of Christian believers
Congregation	A body of Catholics, usually the members of a parish, assembled together in a church for Divine worship
Conversion	One who turns or changes from a state of sin to repentance, from a lax to a more earnest and serious way of life, from unbelief to faith, from heresy to the true faith
Diocese	The territory or the churches under a bishop's jurisdiction
Encyclical	A circular letter; now almost exclusively a papal document; treating of matters affecting the general welfare of the Church
Eucharist	The sacrament and sacrifice of the New Law received under the species of bread and wine
Genesis	The first Book of the Bible, containing an account of the origin of the world, of the human race and of the chosen people
Laity	The ordinary members of the Catholic Church who are neither clergy nor recipients of Holy Orders or vowed to life in a religious order or congregation
Parish	A definite territorial division of the diocese to which has been assigned its own church
Pope	The bishop of Rome as head of the Roman Catholic Church.

Table 1: Meaning of Catholic terms used in the paper (see: [66])

3.1 SHCI and LIMITS

SHCI research has largely been centered around the use of data-driven, persuasive technologies that take an individualistic, rational, and consumer-centric view to change user behavior such as reducing resource consumption [15, 33]. For example, SHCI researchers have used eco-feedback systems [28, 79], computer games [53, 71], and visualizations [14, 20] to persuade [5, 63], motivate [51], encourage [65], educate [47], promote [45], or influence [55] individual persons to adopt sustainable behaviors. These studies, as Brynjarsdóttir et al. [15] noted, are largely driven by a modernist focus on data-driven persuasion techniques aimed at influencing individuals to live sustainably. Hasselqvist and Eriksson [33] reported that despite earlier calls for a broader, less consumer-centric perspective, SHCI research still largely focuses on data and individuals. There have been some attempts to go beyond this individual, consumer-centered perspective by introducing other frameworks such as ecofeminism [44], desiderata types [40], and practice theory [24]. However, as Remy et al. [72] argued, a gap between these theoretical frameworks and empirical work exists; the theories are not always practical to implement and integrate into people's lives.

LIMITS has pushed against the individual, consumer-centric view [43, 78] by introducing alternative paradigms such as a permaculture perspective [23] and learnings from Indigenous knowledge [89]. These alternative paradigms pose challenges related to bridging the gap between theoretical frameworks and practical application [72]. While LIMITS scholars have discussed various motivations like altruism or feelings of responsibility towards one's community as catalysts for sustainable lifestyles [29, 64, 81, 83], they have not substantially analyzed why some people may feel inclined toward such pro-social or pro-environmental behavior. In our attempts to answer this question, we investigate religious beliefs as an intrinsic motivation for orienting towards such behavior.

3.2 Religion and HCI

Several HCI researchers have emphasized the lack of attention to technology adaptation and adoption for religious and spiritual practices [13, 16]. Over two decades ago, Bell [7] suggested HCI research analyze religion and spirituality as important sociocultural factors intersecting with technology use. She coined the term "Techno-spiritual Practices" to refer to ways in which technology is used as part of religious and spiritual practices [8]. In 2010, Bell stressed considering religion in technology design and use [9]. In 2013, Buie and Blythe [16] reviewed ACM papers on religion and spirituality in HCI, reporting a lack of substantial research on the topics. Since then, HCI has started assessing technologies for conducting religious and spiritual practices include understanding technologies supporting practices in everyday life [85], at Christian homes [86], by ministers [87], use of home automation by Orthodox Jewish families [84], Muslims [39, 73, 85], and Hindus [62] (see also [25, 30, 52]). The COVID-19 pandemic has accelerated technology used for religious practices as institutions moved their offerings online, resulting in requiring people to move their spiritual and religious practices into the virtual world [17, 59, 76].

Despite the real-world connections between spirituality and technology, the HCI community has not engaged substantially with values associated with spirituality, faith, and religion when designing and evaluating technologies. The few studies include Håkansson and Sengers [31] assessing religion as a motivation for simple living, Vyas [82] investigating sustainable household practices of middle-class people in India being influenced by their

Hindu religious beliefs, Akama et al. [4] reflecting on the role of nature from both Shinto and Atheist-Spirituality perspectives, and Rifat et al. [74] analyzing Islamic values practiced in Bangladesh which connect to sustainability. Within LIMITS, studies have not focused on the role religion or spiritual values might play in orienting an individual towards caring for limits [69]. Extending work on religion within HCI and contributing to work on religion and sustainability [74], we analyze how religious and spiritual values can drive a change towards more sustainable living.

4 METHOD

In this section, we describe the study context, data collection, and analysis process.

4.1 Study Context

The goal of our study was to seek out Catholic organizations in the US working on addressing environmental problems. Unlike the previous studies [74, 82], we planned to look at a more secular context where religion might be less homogeneous and an implicit part of everyday life. However, we agree with Hammer [32] that a lot of Christian structures are embedded in the Western contexts, impacting people and thereby making it hard to disengage their knowledges and perspectives from religious values. As we situated our work in the US, we focused on the organizations part of the Laudato Si Movement[2], a global organization that offers resources and events for Catholics working toward climate justice from a faith lens. The first author knew about the organization through various Catholic groups online.

4.2 Data Collection

We contacted organizations and people part of the Laudato Si Movement. We found a list of organizations and their delegates online, with information to contact them virtually. We reached out to over 100 groups through emails to participate in our study. Many organizations responded to our call. As we started conducting interviews, we used snowball sampling [42] to recruit more participants. From October 2021 to November 2021, we conducted 14 interviews after approval from our university's Human Subjects Review Board. We stopped conducting more interviews when we started noticing repeating sentiments—as we reached theoretical saturation [19]. We investigated how a limits-aware perspective is embedded in the faith of our interviewees and how it played out in their everyday work toward sustainability.

All the interviews were held virtually via a cloud-based video-conferencing application, which was used in video mode for all interviews. These technology-mediated interviews allowed us to reach geographically distanced participants while managing COVID-19 imposed travel restrictions and safety concerns. We recorded the interviews with the participant's consent. All the interviews were conducted in English and ranged in time from 23 minutes to 56 minutes, with an average of 35 minutes. Eight of our participants were members of *vowed religious life*, such as priests and religious sisters, while the remaining six were members of the *laity*. Eight interviewees identified as female and six as male. Interviewees were from different parts of the US. Six participants were based on the East Coast, three in the Midwest, two on the West Coast, and one in the Deep South. The remaining two participants belonged to national organizations serving the US. See Table 2 for more information about interviewees' demographics.

[2]https://laudatosimovement.org/

4.3 Data Analysis

The first and second authors followed the inductive, interpretive coding approach that Merriam [60] proposed for data analysis. The approach includes familiarizing the data, reading through the data, and taking initial notes. We then coded the data; we went through each transcript and highlighted everything related to participants' experiences, attitudes, interpretations, and the actions they have taken to promote sustainability. For example, the codes included "interconnection with nature" where participants discussed how they view themselves as connected with the environment, "a shift to sustainability" where participants reported how there was an active effort in the religious community to move towards more sustainable ways of living, and "learning from traditional wisdom" where participants suggested integrating concepts of sustainable living from the traditional knowledges and ways of living. After we generated the codes, we discussed them with all the authors. The first and second authors inductively analyzed the codes to identify themes, including organizing, reorganizing, and combining the codes. Finally, the authors returned to the data to check that the themes accurately represented the data and adjusted them accordingly. We formed three high-level themes. We present those themes in the paper, describing what each theme meant and how it represented the data we gathered.

4.4 Positionality Statement

Given the nature of the subject matter and in the spirit of full transparency, we include our positionality, especially describing how we relate to and practice our religions and faiths. All the authors are situated in the United States. The first author was born and raised in the United States. They practice Roman Catholicism. They view sustainability as very much intertwined with creating a just global society that allows all beings, human or not, to thrive. The second author was born and raised in India. They grew up in a family practicing Hinduism. They view sustainability as the need to drastically reduce our economic activities to live within the ecological limits. The third author was born and raised in the United States to agnostic parents. They practice green witchcraft and paganism to decolonize themselves, heal ancestral trauma, and deepen their connection with Mother Earth. They view sustainability as establishing a regenerative spiritual connection with ourselves as stewards of the land. The fourth author was born and raised in India. Their family practices Hinduism; however, they do not hold any particular religious belief. The fifth author was born and raised in the United States in a family that practices Hinduism. They do not follow any particular religious or spiritual practice. The last two authors view sustainability as a practical and ethical imperative for a global society.

4.5 Acknowledgment of Harms

We acknowledge the harms perpetrated by the Church throughout history [12, 26, 61, 88]. Participants reported this dark side of the

	Lay / Religious	Gender	Role	Location
P1	Lay	F	Runs a parish Care for Creation group; involved with Archodiocesean Care for Creation group	Midwest USA
P2	Lay	M	Part of a national organization calling on Catholic universities to divest from fossil fuel	USA
P3	Lay	F	Works for a national organization devoted to promoting Ignatian spirituality	USA
P4	Lay	M	Runs a diocese office of Life, Justice, and Peace, which includes work on ecology	West Coast USA
P5	Lay	M	"Retired" Lawyer; runs a parish Laudato Si circle	West Coast USA
P6	Religious	F	Sister who runs much of the ecological work in , particularly with regard to use	East Coast USA
P7	Religious	F	Sister who is a social worker in a clinic in the deep South, USA	Deep South, USA
P8	Religious	M	Priest at who is very involved in sustainability initiatives within his parish	East Coast, USA
P9	Religious	M	Priest who runs the Peace, Justice, and Ecological Integrity Office for of religious Sisters	East Coast, USA
P10	Lay	M	Theology professor who is part of his university's sustainability	Midwest USA
P11	Religious	F	A sister who is part of the sustainability efforts for her congregation	East Coast, USA
P12	Religious	F	A sister who is part of the social justice office for her congregation	East Coast, USA
P13	Religious	F	A sister who is heavily involved in ecological education in her own congregation and with the public	Midwest USA
P14	Religious	F	A sister who works on ecological issues and is also her congregation's representative to the UN	East Coast, USA

Table 2: A summary of interviewee details.

institution. P4 said, *"There's also a side of that story which has been connected with colonization or connected with other forms of domination, and where the Church has not always either maintained that prophetic voice or that voice with care of creation, or has it slipped from view sometimes, or has not been as centered."* We recognize the complicated history of the Church with colonialism, conversions, misconduct, and atrocities committed against indigenous populations worldwide. Some of the authors have (in)directly faced such consequences.

5 FINDINGS

In this section, we discuss the themes we uncovered to answer our research questions. First, we describe how ecological limits are conceptualized from a Catholic Ecospirituality perspective, noting that this perspective goes beyond the current ecological crisis and is fully aligned with the scientific reality of climate change. Second, we look at how this conceptualization motivates action from both top-down and bottom-up perspectives. Finally, we examine how technology could assist or obstruct the operationalization of Catholic Ecospirituality.

5.1 Conceptualize Limits

We examined that people practicing Catholicism perceive ecological limits as a part of their faith by transcending the current moment, perceiving nature as intrinsically good, and associating their faith with science.

5.1.1 Transcending the Current Moment. For our participants, concern for the environment, which is often referred to as *"caring for creation"* among Catholic groups, was often a part of their faith. Participants reported that they view ecological limits and the need to turn towards more sustainable living as a mandatory value prescribed by their religious scriptures and traditions. For example, P11 said:

> "*It [living within ecological limits] is a part of a Gospel mandate. It is not just something that you know we are kind of casually interested in. This is essential to who we are.*"

Interviewees' concern towards caring for creation did not result from the global ecological crises that we face; however, this care was integral to them; they have always cared about the environment. The repercussions of the global sustainability crisis might be different, but care as a value was ingrained in the ways interviewees practiced their faith. For example, P4 told us:

> *"We want to think first as Catholics, and this [ecological limits] should not be really a new issue. I mean, it is a new crisis moment that we are in, but I mean, our faith has taught us from the very beginning to be good stewards and caretakers and lovers of this earth. I mean, we come from a tradition of nomads and migrants and gardeners, and you know monastic communities, and you know any number of ways that the Catholic tradition has always nurtured a deep love for creation and a part with that spirituality that goes with that.".*

Although caring for the environment has been integral to our participants, the value was not prevalent among the larger community. P9 said, despite the *"Gospel mandate"* to care for creation, it was not made a priority by the Church. However, as the sustainability problems became prevalent, people started becoming more aware of the issues individually. P9 reported, *" That has certainly been a very distinct development in the past 20 years or so in religious life, that people are much more conscious [of sustainability]"*. The awareness about sustainability was further raised when the religious leaders started stressing living sustainably. P9 said:

> *"As Pope Francis puts it in Laudato Si, care of creation is not a secondary or non-essential element of the Christian life, so if it is not secondary or non-essential, it is primary and obligatory. So I think, increasingly in recent years, people have become much more conscious that this is not just a matter of adding green and stir. It is a matter of a whole new way of looking at how we relate to God through creation."*

5.1.2 Perceiving Nature as Intrinsically Good. Participants were motivated to care for nature. Their motivation was based on their religious belief that God created nature, and thus it has an intrinsic value. According to them, the value of nature cannot be—and must not be—measured by its utility to humans. This idea was evident from the interpretations of the religious texts that participants shared with us. For example, while discussing the creation story as told in Genesis, P10 stated:

> *"The thing is, nowhere in that whole creation story, nowhere does it say that these things were created for us and simply for our good. They are good in themselves."*

This perspective towards creation being created by God as an entity in itself and not to serve humankind was reported by many of our participants. While mentioned in the religious texts, due to multiple interpretations of such texts, down the line, this notion of creation having its own intrinsic value was lost; the scriptures were misinterpreted, and thus, people of faith started believing otherwise. P9 said, *"So I do not think you know anybody ever specifically told us that the world, the world exists to serve your purposes... [however] for a variety of complex reasons it did play out in that way."* P9's statement indicates that the intrinsic good of nature has not always been recognized in the way that the faith demands. P13 emphasized the misinterpretations of religious texts that have happened, specifically pointing to an incorrect translation over the course of time, saying:

> *" I say, for the early Hebrews 'dominion' means blessing or being a blessing. We are called to be a blessing for the rest of creation. It does not mean that we are to dominate and have mastery over, which is how we've interpreted it, and there are so many other places in that story of Genesis where you take words that we've interpreted and then assumed it meant something and that wasn't in the original. Like even the word to till the soil. The Hebrew word that we interpreted as to till could be interpreted as to serve, preserve, or hold sacred."*

Caring for creation was a faith mandate that coming from the religious teaching based on the idea that because nature is a part of God's creation, it must be intrinsically good.

5.1.3 Associating Faith and Science. We noticed that participants perceived faith and science not as distinct but associated with each other. They did not perceive science and faith in tension with each other, but according to them, the two are talking about the same realities using different vocabulary. For example, P13, said:

> *"The intersection of theology and environment, there really isn't an intersection. It really is one context, and so I do spend a lot of my time trying to get people to understand that we're not talking about two separate issues here."*

Participants' beliefs regarding nature were compatible with the science on the current environmental crisis. P9 explained how the belief of nature having an intrinsic value fits with modern scientific beliefs. They said:

> *"We also have a different idea of God's relationship with the creation with the acceptance of evolutionary thought that the created universe existed for more than 13 billion years before humans appeared. So, God must have had some purpose for it all before we showed up to be dominant, to have dominion over it."*

Participants reported that in order to raise awareness about the sustainability issues, they had made several attempts to explicitly reminded people of the association between faith and science. P4 told us:

> *"I think that's just the role that we play as a church and helping to remind people why we engage on these issues, and then trying to turn to trusted voices on the science and the advocacy and the other work."*

People have primarily misinterpreted faith as being the opposite of science. Participants reported that the reason behind this misinterpretation was taking the stories described in the religious text literally instead of understanding the teaching they convey metaphorically. For example, P11 said, people have started to recognize the connections between faith and science:

> *"All of us have evolved to understand that science and scientific discovery is very much part of our growing and evolving as humans. And for us, that means that in our spirituality that helps us move the whole enterprise of Jesus that much further in bringing about a kindom*[3] *that is more just, more loving, more nourishing towards everyone."*

P3 added, *"Catholic theology doesn't believe that Genesis literally happened. It couldn't have."* For Catholics, Genesis is a story with *"spiritual truth"* but not historical or factual truth. Our participants' understanding of their faith was linked to their understanding of science. For P13, this means, *"When our cosmology, our understanding of the universe, changes so must our understanding of the divine."*

5.2 Operationalize Limits

When talking about taking action on sustainability, P5 referenced the Second Book of James, saying that *"Faith without works is dead."* For our participants, it was important to put their values with regard to sustainability into practice. However, they expressed an

[3]Note that some congregations are using **kin**dom instead of **king**dom to promote a less hierarchical worldview.

interesting dilemma about how sustainability initiatives have been operationalized by Catholic organizations. The Catholic church has historically been extremely hierarchical [37, 70]. We noticed the hierarchical structure in the ways sustainability is practiced in Catholic organizations. Sustainable living was practiced in a top-down manner consistent with this hierarchical organization. However, many study participants were also engaged in bottom-up practices to promote sustainability. We detail how each of these strategies plays out in practice.

5.2.1 Top-Down Operationalization. At the time of the interviews, the Vatican was rolling out the Laudato Si Action Platform[4]. Given that the platform came directly from the Vatican, it demonstrated the top-down approach to sustainability. Many participants mentioned that they were preparing to participate in the platform.

We noticed the top-down approach in the way participants used institutional resources. The Catholic Church controls a great deal of resources and assets, including universities, land, and other financial and congregational investments. Many of these intuitions were working towards using their resources in ways that promote sustainability. For example, P2 ran an organization dedicated to encouraging Catholic universities to divest from fossil fuels. Many of the congregations of religious sisters had significant investments, which they used to fund their daily necessities and mission work. P6 said that the congregation she belongs to is working toward divestment from unsustainable practices. P11 and P14 told us that their congregations were engaged in trying to make their investment portfolios more sustainable. P14 reported, *"We also try to look at our investments. That our investments, for example are not promoting fossil fuels, so we try to have responsible investments."* P11 talked about how they monitor the companies in their portfolio, saying:

> *"Our investment portfolio is very focused on that, so we have a lot of our effort goes into monitoring some of the companies, corporations, that we invest in, and if they are not in compliance. Let's say for example Exxon Mobil. We did a lot of work with Exxon Mobil. They were not compliant so we took them out of the portfolio."*

P6's congregation had created a land easement, a legal ban on future development, to protect the land they own, particularly considering that their aging population of sisters might no longer be able to maintain the property.

Other participants invested in various green technologies, such as solar panels (P6, P7, P8, P10, P13). For example, P8 reported that their congregation *"went through this whole project of geothermal heating and cooling of the conference center and the chapel"* at a retreat center they owned. P9 told us that adding solar panels to their church building gave them hope during the COVID-19 pandemic. They said:

> *"The building itself, independent of us, is now doing good. And that was a really important theme during COVID when everybody feels passive, that you can literally say, well, my church building at least is doing good. And, think about this, you're 85 years old, and you love your Parish, and you feel helpless, as you get older that I can't do anything, ah, but I was helping to put into place something that will do good, even though I personally can't do it. It's setting up the system, if you will, of sustainability, from the building itself. That the building becomes then the instrument of good."*

5.2.2 Bottom-Up Operationalization. While many of the congregations we talked to were highly engaged in sustainability initiatives, this was not the case with the leadership in all parishes. For example, talking about their local clergy, P1 told us that:

> *"The priests and the clergy just have a really difficult time understanding or coming on board [on sustainability initiatives]. Even though they sort of say they are, but they are not."*

While P6's religious congregation was engaged in sustainability efforts, they noted a similar difficulty in their local parish[5]:

> *"We do not have an active involvement from our parishes and from our priests and our pastors. We're building up this grassroots movement."*

In such cases, parishioners, for example, P1 and P6, have worked toward starting their own local groups in order to spread awareness and take action. P1's group had held various educational events such as showing videos on sustainability and taking actions such as composting waste from church events. Similarly, P6 told us about the efforts they have taken, saying:

> *"The Parish that I belong to, finally we got permission after all these years.It was a small number, but the pastor gave us permission to do something for the season of creation."*

Other congregations and parishes partnered with other grassroots organizations because they acknowledged promoting sustainability as a part of their mission. For P12's congregation, promoting sustainability was embedded in their call to *"tend to the dear neighbor."* P12 said:

> *"We were founded with the idea that we would be seeking a relationship with God and our dear neighbor to bring our neighbor, and with neighbor, to minister without distinction among those that we were serving."*

Therefore, they made it a point to work with local organizations in the communities they serve. For P8, this conception of neighbor goes beyond just the local community. They mentioned reflecting on the question, *"Who is my neighbor?"* Asking this question led P8 to make intentional choices about the programs their parish supported at different levels, ranging from the national to international level. P8 added:

> *"My criteria for what program we are going to do is, one, they have to have a track record, but two, they have to have accountability and involvement of the local, grassroots people... I don't go through big top-down organizations, I always go through the grassroots up, because that's where we are, and that's what I want to support."*

One of the most exciting cases of grassroots involvement was P5, a retired lawyer who used his legal skills to bring suit against

[4]https://laudatosiactionplatform.org/

[5]In some cases sister live spread out in communities in small groups of two or three.

the large oil and gas companies for spreading misinformation. He told us about his conversation with the companies:

> *"I had to at that point say you know who am I, so at that point, I represented no party except for the Laudato Si Circle at our parish. And there was a bit of a pause, and so he said you're doing this through altruism, and I paused... I just said, well, you know I'm not being paid for my call to you today in dollars and cents, but you know he was interested, maybe shocked that I was contacting them on behalf of, you know, this kind of Franciscan group."*

By working from a grassroots perspective, he could make more impact than he might have if he had taken a top-down approach, P5 reported.

5.3 Technologize Limits

Outside of the participants representing national organizations who were well versed in using technology to reach their geographically disparate members (P2 and P3), computing was not seen as an essential part of our participants' sustainability initiatives before the pandemic. The pandemic changed this by giving many congregations, in P9's words, *"Just an awareness of the danger of plane travel."* P9 went on to say:

> *"That's been one of the side blessings of Covid and Zoom... A lot of Community meetings take place virtually. But we would not have made the ecological connection before, but now we certainly do."*

However, participants recognized that there were additional benefits to technology. One major theme that emerged from the use of technology was the ability to create global connections and put a human face on the climate crisis which we talk next.

5.3.1 Opportunities with Technology. Many participants told us how technology allowed them to connect with the global community. They witnessed the challenges that people impacted by climate change face, especially as participants do not face substantial repercussions of climate change themselves. Technology helped them connect with and understand the concerns that were not immediately visible to them. For example, P3 said:

> *"I think for the vast majority of people like really being able to concretely see these [sustainability] issues with water [crisis] are really impacting people's lives or like me getting like my electricity from this coal plant is having a disproportionate effect on this community of people... I think the more we can use technology to kind of make those connections and show those stories that are really complex... I think that that could be like an impactful kind of path towards conversion."*

Participants shared their perspectives on how they felt more connected to the global Catholic community via technology. For example, P4 reported how technology allowed them to feel more of a connection to the global Church:

> *"You know that Catholic means universal and global essentially, but when you're actually you know, in a live call with people around the world who are Catholics working on this stuff [sustainability] it's really cool you know, and it really gives you a different appreciation for communion in that way, and as a communion, and so so that's really invaluable."*

5.3.2 Limits to Technology. While some participants appreciated how technology allowed them to access global connections, other reported that they faced a challenge with not letting technology replace the in-person connections they have established over the years. They emphasized the limitations of technologies they used for their work practices. For example, P4 described this tension, saying:

> *"Interconnectedness [to earth] and technology is a sort of a wild card in that right. In some ways it [technology] really helps us to see our interconnectedness, and in other ways it can sort of remove us from our concrete locality, and like, earthiness of that place and puts us out into this virtual world."*

Participants mentioned that the technology limited them from connecting with others to perform their spiritual practices. For example, P13 found it difficult to sustain engagement with others over technology. She told us:

> *I am finding that one of the things that's hard...looking at a screen and the kind of energy that it takes to do a program or to do a retreat... when you're with a group of people you're getting their energy back... after a day of doing that [running a Zoom retreat] I find myself absolutely exhausted. When I'm with people doing that I'm energized."*

While participants appreciated technology, they were wary of its use. They emphasized that to live a healthy spiritual life, in-person connections are important. This sentiment was evident in P7 statement *'it's those relationship, we live in community, so being engaged with other sisters is an important part of my life, my work, and my spiritual life."* P8 linked faith and personal connection, saying:

> *"The heart of our faith in terms of Catholics, as Christians, is the incarnation. The word of God becomes flesh and Jesus. The touchable. That's my biggest problem with technology, how people are using it, because they're so pragmatic and they want to maximize return. Well, maximizing return diminishes human in a lot of ways.'*

For Catholics, physically receiving the Eucharistic host is a part of their faith and worship. The physical presence is not something that can be replaced or done virtually.

6 DISCUSSION

How can we continue to use technology to foster connections across boundaries while still prioritizing groundedness in the real world? Our participants were wary of technology replacing tangible connections with other humans, the earth, and the rest of creation. As technologists, we may be tempted to see the promises of information and communication technologies for drastically cutting the carbon emissions associated with in-person worship by reducing driving. There has been a recent turn towards practicing spirituality in metaverse "churches" [35]. However, for Catholics, this becomes unappealing from a theological perspective. As we noted, for Catholics, the tangible reception of the Eucharist is paramount

to practicing the faith. Any technological solutions designed to help parishes or congregations practice their faith more sustainably must keep in mind that physical buildings and gatherings cannot be replaced. Designers can incorporate such crucial factors to design sustainable technologies in support.

We might think to P8's comment that after installing solar panels on the church roof, *"the building becomes then the instrument of good,"* to consider other ways to use computing to help parishes and congregations manage their buildings in the most sustainable manner possible. One example is devices like IoT thermostats to help regulate heating and cooling in line with both building use and sustainability. Another example is to think about how parishioners are coming to worship. For instance, technology might be used to encourage individuals to use alternative forms of transportation to get to mass or to carpool with other worshipers. These actions have been looked at by HCI scholars from a pragmatic standpoint [34, 41, 48, 54]. However, we can imagine integrating a faith-based component into such technology to go beyond presenting alternative transportation as a means of "caring for creation" to presenting it as an opportunity for building community with other parishioners or for serving people in the community like elderly individuals who may not be able to drive themselves to mass or similar church events. We could respect the bounds of sociocultural factors and work within them to find ways to promote sustainable living instead of placing these factors at odds with each other.

For those who are religious, faith is typically a matter of lifestyle beyond just attending services or participating in prayer. We quoted P5 paraphrasing the Second Book of James, and P7 seconded this idea by sharing a quote attributed to Saint Francis of Assisi, *"Preach the Gospel always and everywhere. If necessary, use words."* Rifat et al. [74] have noted that Muslims were similarly inclined toward taking action in pursuit of their faith. We can think about what it could mean to build technology that supports religious action. We can design technologies that help coordinate alternate transportation for church activities. We can design platforms to help church members find local volunteer opportunities and foster connectedness through, for example, a virtual music-making tool, or build systems to help parishioners participate in political advocacy efforts.

While faith and action go hand in hand, it would not be amiss to focus on leveraging and building the underlying values. As P12 told us, *"I see it as a cycle. Advocacy, systemic change has to be in a cycle of prayer, contemplative prayer, and then your education and action and your advocacy so that it's one."* While the media often portrays religion and sustainability at odds, our participants have shown us that this is not always the case. Knowles et al. [50] argue that we need to understand the psychology of what drives people to do sustainable works and then promote those values. By fostering faith values and tying the faith to pro-social values and ecological issues, we might help promote the paradigm shifts needed for people to take action and keep these issues front of mind.

Many Catholic prayers and meditation apps exist; for instance, the app Hallow has raised over $50 million in investments and been downloaded more than one million times [58]. At the same time, there has also been an exploration into the role of reflection [38, 46] and pro-social values [49, 50] in promoting sustainable behavior. We could design applications to promote religious reflection or prayer with a focus on sustainability. This might come in the form of reflection on statements from Laudato Si, or prayers from Saints[6], such as St. Kateri Tekakwitha, a patron saint of the environment, and St. Francis of Assisi, a patron saint of animals and ecology.

Many applications were designed to help people reduce their carbon footprints by presenting data about the footprint of activities, such as eating meat, driving, and electricity use [15]. We can imagine designing such applications that combine aspects of the faith like a meditative prayer with suggestions for climate action. Leveraging faith as a motivator for sustainable change could be more effective than a purely data-driven approach.

HCI scholars have reported that sustainability requires a cultural shift [15, 22, 56]. For example, in a recent Interactions article, Ann Light [56] argues, *"What we face in pursuit of material progress can only be unmade if our goals globally turn to Regeneration and care. We need to design the interactions to carry that change forward."* Regeneration and care underpin ecospiritual ethos. It is important that the technologies we design support interactions that reflect these principles. The LIMITS community has not substantially focused on religion despite how prominent a part it plays in lives and cultures worldwide. We recommend that this community deeply consider socioreligious contexts in the design of technologies, particularly contexts where religion is not homogeneous and not integrated into governance structures.

7 CONCLUSION

Through the study on Catholic Ecospirituality, we presented how religious values can significantly motivate people to care for limits and thereby work towards more sustainable living. Through interviews with individuals and organizations working toward sustainability, we distill four crucial lessons for the LIMITS community. First, we encourage the community to consider the needs of religious communities to design technologies to help achieve more sustainable practices. Second, we suggest the community considers designing technologies to help people put their faith into action towards advocating for sustainability. We call on the community to recognize the power of promoting faith values through reflection as a means of helping people achieve the mindsets needed to promote sustainability. Finally, we encourage the LIMITS community to study socioreligious values that support the paradigm shifts towards recognizing ecological limits.

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