Still Not a Lot of Research? Re-Examining HCI Research on Religion and Spirituality

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ABSTRACT

A decade after Buie and Blythe's review "Spirituality: There's an App for That! (But Not a Lot of Research)", this sequel assesses the evolving landscape of Human-Computer Interaction (HCI) research on religion and spirituality. While the enduring importance of religion and spirituality for humanity and its influence on technology use remains, the last decade has seen transformative shifts catalysed by technological advances and the global impact of the COVID-19 pandemic. This paper explores whether and how HCI research on religion and spirituality has also changed. Providing a snapshot of the current research, we document and reflect on changes in the lines of research with a shift towards community, an increased consideration of religion and spirituality in related areas such as health, education, and society, and the broadening of challenges for HCI research on religion and spirituality.

CCS CONCEPTS

• **Human-centered computing**;

KEYWORDS

scoping review, techno-spirituality, religion, faith, spirituality

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1 INTRODUCTION

Religion and spirituality are essential aspects of life for the majority of people, and projections suggest that the number of people unaffiliated with a religious group will decrease over the next few years [29]. Religious and spiritual practices are now increasingly mediated or supported by interactive technologies[1], often referred to as *techno-spiritual practices* [15]. During the COVID-19 pandemic, for example, online worship services and rituals have increased [25, 35, 78, 118]. Furthermore, religion and spirituality (R/S) change the needs expressed towards technology in general, be it through specific requirements derived from religious practices (e.g., prayer times) [38] or through personal values and social structures shaped by religious norms (e.g., differing gender roles as suggested by religious scriptures) [53]. As a result, HCI researchers could greatly benefit from a better understanding of the interactions between R/S and interactive technologies and how to adjust interactive technologies to meet R/S needs.

A decade ago, Buie and Blythe published a provocative review of religion and spirituality. The review examined both the iTunes App Store and the ACM Digital Library for relevant content. Although HCI papers had covered R/S research, there were only three main strands of research (as of 2013) [22]: *institutional* research, which examined how religious communities adopted new technologies; *practical* research, which examined how technology indirectly helped people's spiritual practices; and *experiential* research, which examined how technology could support the immediate religious or spiritual experience.

Despite the positive fact that Buie and Blythe found HCI research on R/S, their review is far outweighed by the troubling findings, which essentially comprise four key issues [22]. First, HCI research on R/S in 2013 was best characterised by its scarcity. There was only little HCI research on R/S despite its high real-world relevance and the vast amount of religious and spiritual apps available in the iTunes App Store [22]. Second, little HCI research had looked at aspects of R/S in detail. For example, Buie and Blythe identified four classes of papers that only marginally addressed aspects of R/S [22]. The papers addressed R/S as only one of several components (Buie and Blythe named this class *covering*); The papers produced relevant findings but did not focus on R/S per se (class named *finding*); they addressed peripheral topics of R/S (class named *peripheral*), or they took a meta-perspective and called for more research (class named *meta*). In contrast, only two classes of focused engagement with R/S were described, such as papers documenting designs to promote R/S experiences (class named *design*) or papers primarily contributing knowledge on the topic (class named *focused*). Third, HCI research on R/S did not address all issues relevant to real-world experiences in the context. For example, Buie and Blythe noticed that several topics covered by real-world applications in the iTunes App Store had been neglected in HCI research, such as education, prayer exchange (e.g., sharing the need for prayer and having others pray for the concern), or comparisons of different faiths [22]. Fourth, there were unique challenges that may have explained the lack of

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[1]We use the term (interactive) technology in line with Pierce's understanding as "the technology that HCI as a field is primarily concerned with [... entailing] some type of electronic, digital, computational, or information technology" [88, p. 960].

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research [22]. For example, Buie and Blythe speculated that HCI research on R/S may have been lacking "because it's difficult?" or "because it's sensitive?" [22, p. 2321].

The provocative review concluded with a passionate plea for more research [22], and we feel that now, a decade later, it is time to take a new snapshot of the state of research and ask: what has happened since Buie and Blythe's review? Undoubtedly, much has happened in terms of technology (and technology use): Technological advances such as more affordable virtual reality headsets[7, 89] or more accessible AI tools [36] have changed the possibilities for the techno-spiritual "re-purposing [...] of the internet" [15, p. 2]. In addition, the global COVID-19 pandemic profoundly affected the way people communicate. Contact restrictions increased the need to connect online, to which churches and religious communities adapted [25, 78]. But has HCI research on R/S also changed? On the occasion of the 10th anniversary of Buie and Blythe's review [22], this sequel aims to repeat the review of related HCI research and answer two research questions (RQs).

RQ1: What have studies focused on in the last decade?

RQ2: How have the assumptions about research challenges changed over the past decade?

2 METHOD

Overall, we tried to roughly replicate Buie and Blythe's methodology with some specifications and adjustments [22]. We found that the framework for scoping reviews [9] best reflected Buie and Blythe's review and decided to follow the general idea of the PRISMA extension for scoping reviews [113]. Like Buie and Blythe, we searched the ACM Digital Library[2] database using the terms listed in their review [22]. An initial full-text search returned a total of *41505* papers. Given this large number and the questionable relevance of many returned papers, we decided to use an abstract-only search to identify the genuinely relevant papers. Consequently, we did not include papers that only briefly touched on the topic of R/S, which, we hoped, would also help to focus our results rather than dilute them. We included papers from 1st Jan 2013 to 8th Nov 2023 to cover all papers since Buie and Blythe's review in 2013 [22]. The search was performed on the *08.11.2023* and returned *747* results. The 747 abstracts were scanned and assessed regarding the paper's relevance to the topic of HCI and R/S. Papers were excluded based on three criteria: First, the keyword in the abstract having a descriptive purpose only and not explicitly suggesting it as being essential for the content of the paper, e.g., "in good spirit" or "in good faith" (e.g., [97, 109]). Second, papers that either barely or not at all addressed either the topic of R/S, e.g., [63], lacked a technological component altogether, e.g., [26], or discussed vastly different topics, e.g., [27, 46, 120]. Third, papers that did not present research, such as contributions from PhD consortia and papers that were not accessible from the university server. However, care was taken to ensure that abstracts that suggested relevant findings for the topic were still included.

After the abstract screening, *124* papers remained, which were then downloaded and scanned one by one. Before the full-text screening, a spreadsheet was created containing relevant aspects for the later review, such as the type of technology used, the contribution and motivation of the study, or the definition or description of religion (see supplemental materials). After further inspection, *19* papers were excluded for different reasons. For instance, some papers did not have a suitable format (e.g., [12, 41]) or did not contain a relevant R/S aspect, as previously incorrectly deduced from the abstract screening (e.g., [65, 72]). The distribution of the final *105* papers along the publication years can be seen in Figure 1, and a list of all papers can be found in Appendix A.

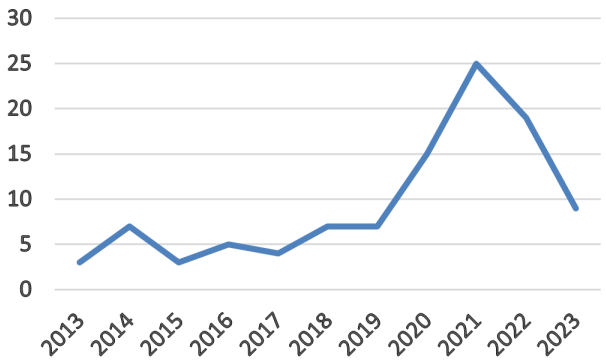

Figure 1: Number of papers on R/S per year within the last ten years.

We analysed the final set of *105* papers concerning the two RQs. To do so, we compared the themes and categories used by Buie and Blythe with the themes present in the final set. In addition, we created new themes for papers that did not fit into any of the previous categories. A detailed overview of all papers and their characteristics in relation to the different themes can be found in the supplemental materials. The structure of the results follows the approach and style of the Buie and Blythe review to facilitate comparison of research findings [22].

3 RESULTS

In the following, we present the results structured according to the two RQs: (1) What have studies focused on? and (2) How have the assumptions about challenges changed? In each section, Buie and Blythe's [22] findings are briefly reviewed and placed in the context of this review. New themes and findings are then presented to allow a direct comparison of the findings ten years on.

3.1 RQ1: What Have Studies Focused on in the Past Decade?

3.1.1 How central is the topic of R/S in HCI papers? Buie and Blythe [22] divided their set of papers into six classes to provide a high-level overview of research approaches to R/S and HCI research (see Table 1, 2013 Count). While two classes contain papers that focus more on R/S (*focused*, *design*), the papers in the other four classes touch on R/S more marginally (*meta*, *peripheral*, *covering*, and *finding*). We tried categorising the papers in our set accordingly but faced some difficulties. For example, we did not find papers that matched the classes *covering* and *finding*. As both classes only

[2]https://dl.acm.org/

Categories	2013 Count	2023 Count
Focused	22 (22.4%)	16 (15.2%)
Design	7 (7.1%)	27 (25.7%)
Meta	12 (12.2%)	7 (6.7%)
Peripheral	33 (33.7%)	55 (52.4%)
health		27
education		16
society		12
Covering	10 (10.2%)	
Finding	14 (14.3%)	
Total	**98**	**105**

Table 1: Distribution of papers across classes proposed by Buie and Blythe [22] and novel subcategories.

marginally relate to R/S, relying solely on an abstract-based search rather than a full-text search may have contributed to this issue. However, we were able to find papers for all other classes, *focused*, *design*, *peripheral* and *covering*, and identified three novel subthemes within the *peripheral* class highlighting unique focal topics relating to R/S (see Table 1, 2023 Count).

Papers in our set that focused more on R/S either contributed knowledge primarily focusing on R/S (*focused*) or described novel designs fostering R/S experiences (*design*). An example of *focused* research is Claisse and Durant's paper, which addressed video-mediated online communication during the pandemic within the Buddhist community [35] or Abokhodair et al.'s paper, which explored Quran sharing on Twitter [2]. An example of *design* research is the *God-I-Box*, a novel provocative prototype for technology-mediated worship services [119].

In terms of the more marginal consideration of R/S, papers in our set either took a *meta* perspective or addressed R/S in a *peripheral* way. Papers referred to as *meta* often did not report a study or own research but, for example, called for participation at a workshop and reported briefly about the topic they addressed [68, 91]. Papers referred to as *peripheral* mainly focused on topics only related to R/S but provided relevant insights for R/S. *Peripheral* papers were very prevalent in our set (n = 55), so we wanted to better understand the kinds of topics focused on and identified three novel sub-themes, namely *health, education, and society*.

The sub-theme *health* entails papers addressing the role of R/S within healthcare. For example, Smith et al. argued that spirituality and religion specifically gain importance during health crisis [99], which amplifies the need for spiritual support [43]. A few papers also addressed mobile health applications designed for faith-based communities, like the *Church Connect* mobile application, designed explicitly for predominantly Black Churches [82]. The second sub-theme *education* includes papers that address religious or spiritual technology-based education like, for instance, Candice et al.'s paper that discussed game-based teaching about religious monuments in Singapore [1]. Research within this subcategory also addressed the use of novel technology within education, such as using Augmented Reality to transform a real-life artefact into a digital artefact and use it to teach about Japanese culture [58]. The third sub-theme, *society*, comprises research examining the interdependence of society, cultural environment and R/S mediated by technology. For instance, Ibtasam et al. discussed the design and use of digital financial services for women in Pakistan, which is influenced by Islamic law and the role of women in Islam [52]. Moreover, some studies addressed sustainability, e.g., in Islamic communities [92], or explored the influence of religious values on pro-environmental behaviour [125].

3.1.2 What are the main strands of research? Buie and Blythe identified three lines of research within their set of papers, namely *institutional*, *practical*, and *experiential*. We analysed our set of papers in terms of these three lines and identified an additional one, *community*. Note that the themes may overlap and are not mutually exclusive, as different papers address several themes at the same time.

Institutional: The institutional theme (n = 39) addresses research focusing on how religious organisations adopt new technologies, e.g., for new ways of communicating, and integrate them into their religious or spiritual practice. For instance, Maulida et al. conducted a study about the possibility of using TikTok for Islamic learning [69]. They argue that "the features provided by the TikTok application are very diverse and easy to use so that Islamic religious learning is much more interesting" [69, p. 5]. Albadi et al. addressed the opportunity to spread Arabic content in video form through YouTube and additionally discussed harmful content that aggravated the sharing of religious content within their community [5].

Practical: The practical theme (n = 37) includes research that enables people to perform their religious or spiritual practices, yet it does not aim to directly create religious, spiritual, or transcendent experiences. For instance, Wang et al. describe their creation *TransLive*, which they explain to be a "system [...] that situates the liveness experiences in a domestic environment and positions ambience and aesthetics in the centre" [115, p. 1]. Their technology enables a form of live broadcasting that, in their respective study, is able to create a level of transcendence and leave a calm and pleasant feeling. However, the design could also be transferred to other contexts. As another example, Chen et al. attempt to bring together smart home technology and the ritual of using an almanac [32].

Experiential: The experiential theme (n = 28) primarily focuses on religious, spiritual, or transcendent experiences and addresses design relevant to enhancing such experiences. For instance, Liu et al. took the infamous idea of flying in a dream and used virtual reality to allow participants to have a *self-transcendent experience*. This was motivated by the positive effects of self-transcendent experiences on an individual's overall well-being [60]. Claisse and Durrant investigated the video-mediated practice of "chanting" (via Zoom), which is a common practice within the Buddhist community [35]. Similarly, with their *SoulGarden* prototype,[55] attempted to visualise spiritual supporters online [55].

Community: The novel theme we identified, Community (n = 45), encompasses research that focuses on technologies with the primary purpose of connecting individuals within a (faith-based) community and providing a sense of belonging to those individuals. This theme is likely to have been prompted by the emergence of the COVID-19 pandemic, as a pressing need emerged for technologies to connect individuals and provide a sense of belonging and togetherness [54]. The research explored different ways of achieving

community. For example, some papers described the use of technology to enhance connections between individuals, such as the *Prayer Wall* [82] or the SoulGarden [55], which allow the visualisation of a spiritual support network and the presence of their community despite the lack of a physical connection. Furthermore, wearables, i.e. devices that are worn close to or directly on the surface of the skin, such as the *Wearable Aura*, can also mediate connections between individuals [61], for example, by acting as a conversation starters [132]. Another way of achieving social connectedness was described by research that explored how technology itself could act as a companion, or *companion technology* in the sense of [76]. In these examples, technology was conceptualised not as a tool but as a counterpart, similar to a human [96, 117], and embodied a form of uncontrollability that is commonly found in human-human interaction [117]. For instance, O'Leary et al. discussed the use of a virtual agent to provide spiritual support by, for example, teaching about the Bible or encouraging prayer during health problems [82].

Previously neglected topics: Lastly, in their review, Buie and Blythe also discussed content-related discrepancies between existing technological applications and HCI research [22]. Topics that had been addressed in real-world applications, such as *education* or *prayer exchange*, were missing in HCI research. We identified some papers in our set concerning those missing themes. For instance, the topic of *education* has been discussed in various papers (see Section 3.1.1), such as a paper on technology-mediated religious education for Muslim youths [11]. We also found various papers discussing the theme of *prayer exchanges*, such as the *SoulGarden prototype* [55] or the *Prayer Wall* [82]. *Comparison of different faiths* has partly been addressed by studies including participants of different religious beliefs [99].

3.1.3 What are the main technologies and R/S contexts researched? **Types of technologies:** A wide range of technologies is addressed and used within R/S research. This includes technologies such as (1) immersive technology (e.g., virtual or augmented reality [70]), (2) social media or websites more generally (e.g., Twitter [2]), (3) autonomous agents (e.g., virtual agent-based health application [80]), (4) tangible artefacts (e.g., Wearable Aura [61]), God-I-Box provotype [119]), (5) games (e.g., [37]), (6) art installations (e.g., [124]), (7) video-transmitting tools (e.g., Zoom [35]), (8) smart home technology (e.g., [32]), (9) artificial intelligence (e.g., [5], [56]), as well as (10) novel applications that have been developed in the course of research (e.g., BibleCell [57], TransLive [115]).

Religions and traditions: Within the final set, there were *six* broader religious contexts that repeatedly came up: (1) Islam (e.g., Shia [5]), (2) Christianity (e.g., Protestant Church [117], Black Churches [82]), (3) Buddhism (e.g., [35]), (4) Indigenous and Folk Traditions (e.g., Taiwanese folk religion [32], Terreiro [84], (5) Hinduism (e.g., [37], [70]), (6) Chinese Culture (e.g., Chinese calligraphy [50], Chinese Medicine Music Therapy [126]), as well as (7) others (e.g., Pancasila [16]).

Overall, 55 papers were not specifically related to any religious tradition, however, addressed topics, such as transcendence and spirituality, which were not directly linked to a specific religious community. Additionally, various papers, e.g., papers discussing design ideas or a meta perspective kept their discussion of religion much broader and did not focus on one religion in particular. The remaining 55 papers distributed among religious traditions as follows: Islam (15.2%), Christianity (11.4%), Chinese Culture (8.6%), Indigenous and Folk Traditions (4.8%), Buddhism (2.9%), Hinduism (2.9%) and Others (1.9%).

3.2 RQ2: How have the Assumptions About Challenges developed since 2013?

Although a decade has passed, ambiguities remain about the research (or lack thereof) around R/S and HCI. In their review, Buie and Blythe postulate various assumptions when discussing the challenges of doing research at the intersection of R/S and HCI, such as "Because it's difficult?" or "Because it's sensitive?" [22, p. 2321]. The assumptions about a lack of research remain partially valid. Although a considerable number of papers were returned from the full-text search (n = 41505), the number of papers with a more central focus on R/S (papers in the classes *focused* and *design*) has not changed much (Table 1). Challenges such as the difficulty or sensitivity of HCI research on R/S are still topical today and have even been actively addressed in some papers (e.g., [51, 53, 75]). However, there have also been advances and developments within the field. For instance, many papers have discussed the importance of religious values in everyday life and the need to study these values to enable human-centred design of technology [51, 53]. O'Leary et al. coined the term *whole-person* to describe applications that focus on physical, social, and spiritual well-being, allowing for the inclusion of, for example, church members and their needs within HCI [82]. They also discussed the practice of *community-based participatory research* and the possibility of giving marginalised communities a voice in the research and design process. The relevance of R/S and HCI research also became more apparent through the COVID-19 pandemic and the sudden need to connect online and digitise religious practices [35, 56, 93].

In addition to these positive advances, we also found indications of additional challenges in our set of papers that may continue to hold up research on R/S and HCI.

3.2.1 Because R/S and technology are incompatible? Despite previous arguments about the value of supporting R/S practices through technology, sometimes the use of technology might be opposing to one's religion [37]. In their study, Claisse and Durrant, for instance, report about a participant perceiving the used technology as if it was "standing between" her and the Gohonzon (i.e., a sacred religious object within Japanese Buddhism) [35]. Furthermore, Maulida et al. mention a participant's perception of technology as a hindrance in doing worship as it might make people lazy and become their main focus [69]. In the context of financial use of technology in Muslim countries, Ibtasam argues that the design of technology should not come from a place of disagreement with the religious values of a target group or should in any way impose different values onto that group [51]. Markum and Toyama argue in line with this perspective: "Overall, we add a new context in which the implication may often be not to design technology." [66, p. 10]. Sometimes, the decision not to design and impose a technological device onto someone despite it not reflecting or supporting one's beliefs might demonstrate the understanding of one's religious values more than the design itself.

3.2.2 Because there's no tolerance towards a diversity of beliefs? Previous studies have criticised a prevailing Western bias within research. Mustafa et al., for instance, raise awareness about design strategies oftentimes being primarily tailored to a Western audience, which inevitably excludes various communities and religious belief systems [75]. Regions where religion is a controlling force (e.g., in health practices) may not have the same access to technology let alone research that discusses it. In her research, Ibtasam reported an observed reluctance among participants to talk about Islam and to be open about their beliefs and values, which could translate to research regarding religious beliefs [51]. This sheds light on negative stereotypes about certain religious beliefs. There is one assumption that can be derived from Ibtasam's observation, which is a general fear of judgment of "saying the wrong thing" and displaying ignorance or reinforcing negative stereotypes about one's religion. She puts it this way: "Commentary or feedback that questions findings or recommendations as reinforcing patriarchal concepts or segregation can only make populations and its researchers feel inadequately equipped in sharing their stories or push them to further defend their stance" [51, p. 6]. Overall, there should be a general attitude of tolerance towards different religious belief systems, which requires a degree of empathy towards religious and spiritual matters.

3.2.3 Because R/S is hard to define? Buie have emphasised the need for a clear definition of R/S in the field of HCI [21]. Much like religious studies [8], however, HCI struggles to clearly define *religion* and *spirituality*, which makes HCI research on R/S more difficult. Buie and Blythe describe spiritual experiences as "difficult to articulate for those that have had them and difficult to understand for those that have not" [22, p. 3]. Spirituality has been described as part of religion and intertwined with it to the extent that spirituality itself could only be understood through the prior understanding of religion and was even explained by using religious terms [11]. Other papers, however, conceptualise religion and spirituality as separate entities with very different meanings [73, 101]. For instance, religious beliefs have been described as more static and not suspect to change, whereas spirituality was described as providing autonomy and a degree of flexibility during major changes, such as health crises, to adapt to an individual's needs [99]. Moreover, even within one's own religion or spirituality, there can be many different practices and definitions, which may vary from country to country, or even differences on a personal level, as it remains a private and subjective matter. This has led many researchers to establish their own *working definitions*, i.e. definitions that are stated within their research in order to make it more transparent as to what they define R/S to be [35].

4 DISCUSSION

Ten years after Buie and Blythe's review [22], our paper reviewed the studies conducted in the following decade to document changes and opportunities for future research in the field of R/S and HCI. Two research questions addressed the themes and topics that studies have focused on (RQ1) and the potential challenges related to the lack of research (RQ2). Our review has revealed some changes and similarities to Buie and Blythe's 2013 findings, which we will discuss by revisiting the four key issues summarised in the Introduction.

First, *HCI lacks research on R/S in general.* A comparison of the total number of papers included in the final sets shows only a slight increase in papers (Table 1). However, our review was probably narrower and more focused because we searched for abstracts rather than full texts. In turn, our set of papers contains fewer examples that focus only marginally on R/S (cf., no papers in the *covering* and *finding* classes). Furthermore, although the total number of papers is not significantly different from that of Buie and Blythe, their review included a total of 16 years of research (1996 - 2012), whereas we only included ten years (2013 - 2023). This indicates a general increase in the number of papers per year.

Second, *little HCI research focuses on R/S in detail.* Comparing the papers in the two classes that put R/S more into focus (*focused*, *design*), there is a slight increase in the number of papers (Table 1). However, this increase is not evenly distributed between the two categories but indicates a shift towards *design* (with an increase of about 20% compared to the previous review [22]). Several papers reflected on their design processes and explored *participatory design* and *community-based participatory design* (e.g., [4, 82, 104]) as well as *research through design* (e.g., [19, 20, 117]) for designing R/S experiences. However, there was a decline in *focused* papers, i.e. papers that primarily focused their research on and contributed knowledge to R/S, which opens up opportunities for future work.

Third, *HCI research has neglected some topics relevant to real-world R/S experience.* Research over the last decade seems to have evolved and diversified in terms of focal topics. For example, while Buie and Blythe reported that their experiential theme was not prevalent in their final set, we found numerous papers of an experiential nature, e.g., [35, 60]. In addition, Buie and Blythe had identified several themes that were present in real-world applications (e.g., within the iTunes App Store) but neglected in HCI research, such as education, prayer exchange, or comparisons of different faiths. In our review, we identified papers focusing on these topics (e.g., [11, 35, 55]). These developments may indicate a lag, i.e. that R/S applications need to be created and used before they are researched and discussed in HCI papers, or at the effectiveness of Buie and Blythe's call for more research in these areas [22]. This is further reinforced by the visible shift towards research addressing *design* from 2013 to the present. In addition, we found a large number of papers focusing on a new topic, the social and *community* aspect of R/S, which may have been partly driven by the challenges of the COVID-19 pandemic and the difficulties it created for people trying to feel a sense of belonging or connection [54]. These challenges not only emphasised more research on *community* but seem to have prompted HCI researchers to engage with the topic of R/S more generally, as reflected in the increase in published papers from late 2019 onwards (Figure 1). However, a number of potential research topics relevant to R/S remain under-researched, such as quizzes, stories, or guidance for daily living [22], or, more generally, the role and support of common R/S values such as peace, eternal life, love, kindness, sincerity, happiness, or connection.

Fourth, *there are challenges that may contribute to a lack of HCI research on R/S.* Although there have been significant developments in HCI research on R/S, there are still valid assumptions about a lack of research in this area. Research on R/S remains a sensitive, difficult topic and should be treated with appropriate respect [22]. From our point of view, the authors of the papers in our set were

very aware of these aspects and emphasised them (e.g., [53]). However, it seems at least as important that reviewers and readers are aware of the sensitivity and difficulty of the topic when reading and evaluating such papers. The call not to design, which we found to be a novel challenge for R/S research in our set of papers, is not unique to the field of R/S but can also be found in other contexts within HCI such as sustainability or healthcare [14]. Nevertheless, the phenomenon of 'not to design' is perhaps particularly present in the context of R/S. In our view, this challenge should not mean that design is excluded from the outset but that the possibility of conducting HCI research without resulting in a designed artefact should be accepted if it is not valuable to the cause itself. Technology should not become an end in itself, especially not in the context of R/S, because then it defeats its purpose in any case. The papers in our final set cover a broad spectrum of views on religion and spirituality; often, these are not explicitly named or described in detail (see supplemental materials). What exactly religion and spirituality are is a question that has not been clarified by other disciplines such as religious studies or the social sciences more generally [8, 11, 101]. In these disciplines, definitions of religion range from very narrow ones (e.g., functional definitions) to broad ones (e.g., religion as a feeling [95] or religion as an ultimate concern [112]). While the diversity of understandings presents challenges, it also offers advantages, such as multiple lenses through which to view R/S, each of which highlights unique aspects of the complex subject. Thus, probably more important than finding a universal definition in HCI is making the respective understandings of R/S explicit so that the research can be interpreted with these views in mind. In other words, expecting HCI to find the one true definition seems exaggerated, but encouraging HCI researchers to make their understandings of R/S explicit seems feasible.

There are a number of limitations to this review, which also open up areas for future research to extend the review. First, we did not compare academic research and real-world applications, as Buie and Blythe did, because we wanted to focus on the developments within HCI [22]. Nevertheless, it is quite conceivable that a lot has happened in real-world examples, especially considering the technological advances of the last decade, so a renewed analysis of existing applications could provide exciting impulses for HCI. Second, at the very beginning of our review process, we also searched for papers in other databases (e.g. IEEE Xplore), as the HCI community also publishes outside the ACM Digital Library. We were surprised to find many papers that could potentially be of interest for research at the intersection of HCI and R/S. However, for the purposes of this sequel to an article that only includes articles from the ACM Digital Library and given the page limit we faced, we decided not to include these papers in our analysis. In future work, we would like to fill this gap and see our project, which began as a sequel to Buie and Blythe's review, as a prequel to a more comprehensive review integrating papers from more diverse databases. Third, this review only included papers that explicitly referred to R/S. We suspect that there may be other relevant papers that we were unable to find due to our specific keywords or a lack of explicit naming within the papers. We hope that future work will make their connection to R/S explicit, e.g., by utilizing well-established vocabulary within the field so that future reviews can identify relevant papers.

5 CONCLUSION

Although religion and spirituality are essential to many people, are increasingly mediated by technology, and are named in many HCI papers, there has not been a significant increase in HCI research primarily focusing on R/S in the last ten years. Nevertheless, much happened since the provocative review by Buie and Blythe a decade ago. Some topics not previously considered have now been taken up in research (e.g., education, prayer exchange, comparisons of different faiths), entirely new topics have come into focus (e.g., community), and many more technologies have been deliberately designed for R/S contexts. In addition, papers in recent years have documented new challenges for HCI research on R/S - for example, R/S and technology may be incompatible, or R/S is difficult to define. The intention of this review is not to 'point fingers', but rather to remind and discuss the challenges that researchers still face in this area of research, and to call on reviewers and educators to encourage difficult conversations in order to create a hospitable environment specifically within the practice of HCI research on R/S. Throughout the paper, we have highlighted opportunities and considerations for future research. Overall, we agree with Buie and Blythe in their call for more focused research and would like to reiterate that '[a]ny area of life that touches so very many of the world's people and uses technology so heavily can — indeed, must — be a subject for HCI research' [22, p. 2322].

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A OVERVIEW OF THE PAPERS INCLUDED IN THIS REVIEW

No	Title	Author	Year	Reference
1	A Descriptive Analysis of Cohesion within Virtual and Physical Small Groups of Mothers in Bandwidth-Constrained Communities in Cape Town	Dsane et al.	2022	[39]
2	A design approach for authenticity and technology	Su & Stolterman	2016	[105]
3	A focused crawler for mining hate and extremism promoting videos on YouTube	Agarwal & Sureka	2014	[3]
4	A Health Belief Model Approach to Evaluating Maternal Health Behaviors among Africans-Design Implications for Personalized Persuasive Technologies	Nkwo et al	2021	[77]
5	A machine learning approach for sentiment analysis to nurture mental health amidst COVID-19	Khasnis et al.	2021	[56]
6	A world following farmer almanac: speculation on lifestyle interweaving folk religion and smart home	Chen et al.	2019	[32]
7	An Exploration of Self-Transcendence Through Solo-Travel	Chen et al.	2017	[33]
8	Anchoring and transcendence: PD as an 'enabler' in quality of life	Hendriks et al.	2016	[44]
9	Application and Innovation of Five Elements Music Therapy in the Era of Artificial Intelligence	Yuan et al.	2021	[126]
10	Augmented reality applications to support the promotion of cultural heritage: The case of the Basilica of saint Catherine of Alexandria in Galatina	Cisternino et al.	2021	[34]
11	Augmented reality media to express the experience of Japanese food culture	Kobayashi et al.	2020	[58]
12	AURA: Urban Personal Projection to Initiate the Communication	Okada et al.	2018	[79]
13	Awedyssey: Design Tensions in Eliciting Self-transcendent Emotions in Virtual Reality to Support Mental Well-being and Connection	Miller et al.	2023	[71]
14	Becoming: An Interactive Musical Journey in VR	Yadegari et al.	2022	[121]
15	Bibles and BioShock: Affording religious discussion on video game forums	De Wildt & Aupers	2017	[37]
16	Bridging Distances with Life Reviews: A Study on Intergenerational Learning in the History Alive Program	Chang et al.	2019	[30]
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33	Differences in perceived impact of person-centered technology on older adults' quality of life	Madjaroff et al.	2016	[64]
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