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Religion, Robots and Rectitude: Communicative Affordances for Spiritual Knowledge and Community

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ABSTRACT

In light of growing concerns on AI growth and gloomy projections of attendant risks to human well-being and expertise, recent development of robotics designed to fulfill spiritual goals can help provide an alternative, possibly uplifting vision of global futures. To further understanding of the potential of robots as embodied communicators for virtuous knowledge and community, this paper discusses the affordances or possibilities of action of robots for spiritual communication by drawing upon the recent highly publicized case of Xian'Er the robot monk (XE). By discussing XE's communicative affordances including its searchability, multimediality, liveliness and extendibility, findings illustrate how robots can facilitate religious education, augment priestly authority and cultivate spiritual community. Contrary to abstract and dystopic visions of AI, findings here temper extreme pronouncements of societal disorder and points to prospects for pious and positive interplays between AI technology and society while also identifying various limitations for spiritual communication. In doing so, this paper unpacks the profound relations between religion, robots and rectitude, contributing interdisciplinary insights into an understudied area of AI development as faith leaders and adherents interact with new technological features and applications in their desire for transcendence.

A contemporary debate on the global futures of artificial intelligence (AI) concern the fate of human well-being and expertise, including existential risks to human welfare, and mass unemployment in light of automation marked by a 'second machine age' (Brynjolfsson and McAfee 2014). In light of public fears reverberating particularly in North-American and Eurocentric discourse, understanding the prospects of human-machine interaction to promote social cohesion and well-being is timely intervention. Developments in non-western contexts have historically provided an alternative vision for how robots can serve as compelling guides for a harmonious destiny (Geraci 2008; Tamatea 2010). Renewed interest in robots designed to

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fulfill spiritual goals can actively promote advancements toward positive outlooks and ethical dispositions.

Interest in the nexus of religion and robotics is well-warranted, considering historical and present developments in the adoption of new technology by religious practitioners. Although religion and science are often framed in opposing worldviews and in secularist terms, many religious leaders and communities have strategically constructed and managed the latest mediated innovations to compatibly advance moral and technological growth (Campbell 2010; Cheong & Ess, 2012). In recent years, global news stories have featured an emerging class of robots related to religion, highlighting their novelty and prowess to conduct religious rituals and funeral rites (e.g. Softbanks' Pepper robot priest in Japan), lead prayers and religious instruction (e.g. SanTo, a saint-looking robot for Christian Catholics), and issue automated multi-lingual blessings (e.g. The BlessU-2 robot pastor in Germany). Hence, an examination of the capabilities of religious robots is needful to support human spiritual quests for moral flourishing and the construction of religious authority toward a mutually thriving future.

To further understanding of the potential of robotic agents for virtuous thought and action, this paper documents and discusses the affordances or possibilities of action (Mascheroni and Vincent 2016; Schrock 2015) of spiritual robots, drawing upon the recent highly publicized case of a Chinese robot monk. Beyond viewing robots as mechanical implements or technical novelties, this paper attends to robots as embodied communicative agents and digital media objects embedded within intricate social and material landscapes (Berriman and Mascheroni 2018; Guzman 2018). Accordingly, this paper focuses on explicating the communicative affordances, that is, the socially constructed opportunities and constraints that structure possibilities of action by giving rise to a range of communicative practices (Mascheroni and Vincent 2016; Schrock 2015) related to spirituality, practiced within the context of humanistic Buddhism in China. Poised at the foot of the Phoenix mountain vista in the outskirts of Beijing, the thousand-year-old Longquan monastery amidst its panoramic peaks and dramatic cliff inscriptions is an idyllic site for a classical Chinese landscape painting. Yet in "an unexpected synthesis" of science and spirituality (Lu and Robertson 2016), this rustic setting also serves as a crucible for the development of Xian'Er the robot monk (XE) who can chant Buddhist mantras, move via voice command, and hold a conversation. Breaking news of XE have characteristically focused on its novelty as "the robot monk … comparable to a mini-version of Apple's Siri" (Andrews 2016) and the latest innovation to "spread Buddhist wisdom to the digital generation" (Sherwood 2016). However, celebratory but simplistic accounts of XE have obscured its ontological complexity and social contingencies, skewing public understanding of its potential to foster religious practice.

This paper explores the communicative affordances and constraints of XE's development and operations in order to illustrate how robots can facilitate religious education, augment priestly authority and cultivate virtuous community. In doing so, this paper unpacks the profound relations between religion and robotics, contributing insights into an understudied area of AI development as faith leaders and adherents interact with new technological features and applications in their desire for transcendence (Geraci 2013). Contrary to dystopic technological visions of AI, findings here temper extreme pronouncements of societal disorder and points to prospects for pious and positive interplays between AI technology and society. Subsequently, this paper will discuss the communicative possibilities of robots to fulfill spiritual goals, before delving to explore and identify key affordances of XE in the following section.

Literature Review

The Communicative Constitution of Artificial Intelligence

The launch of new robots, including the recent emerging class of robots in the religious domain, are perceived often as fascinating technical novelties or sudden mechanical intrusions into our everyday social and natural world. The headline by the New York Times on their story of XE, for example, reflects this common curiosity regarding an astonishing phenomenon, "A Robot Monk captivates China, mixing spirituality with artificial intelligence" (Tatlow 2016). Yet popular perceptions may shroud the complex operations of new robotics, including ways in which digital technology can facilitate a diversity of new communication practices that undergird the contemporary growth of religion, stanching secularization in rapidly modernizing and highly mediated societies in Asia (Kluver and Cheong 2007).

In this light, a relational approach to technology and communication provides a productive framework to understanding contemporary spiritual robots, and their potential for advancing social good not fixated on a utopia grounded in technological determinism nor social constructivism but evaluating robotics in real-world contexts. Considered in coherence with scholarship on digital religion where cross-cultural communication practices are vitally constituting mediated and evolving religious norms and representations (Cheong 2017; Ess, Kawabata, and Kurosaki 2007), the emerging class of spiritual robots necessitate deeper inquiry and research on their sociocultural and religious implications. What are the possibilities of human-robot communication for cultivating moral rectitude? Are there robotic functions that impact spiritual learning and why? How do users take advantage of actions that spiritual robots make possible for social good? An affordances perspective represents a relational approach to understanding how people

interact with communication technology (Leonardi 2013) and can serve to bridge the value of research focused centrally on the use of particular technical features and accessing how robots are adopted for particular virtuous communication outcomes.

The Nature and Evolution of Affordances for New Technologies

The concept of affordance was first articulated by Gibson (1977) in the field of ecological psychology to represent environmental qualities that offer opportunities for a set of specific actions. In its original formulation, affordances refer to properties of the environment, independent of animals' perception, that help organisms act in response to the challenges of the physical world. As Graves (2007) notes, "an affordance is an invitation – a sense present both in the everyday verb "to afford" and in the roots of affordance in cognitive psychology". In this sense, affordances do not imply that certain behaviors will ensue, rather they contribute to the noticeable prospect of distinctive activity.

Over the years, the concept of affordance has been taken up in varying permutations, not withstanding criticisms leveled at the primordial notion, like its definitional welter and inadequate coverage of diverse subject-artifact relations (Davis and Chouinard 2016). Accordingly, the concept has evolved in its applications in different disciplines. For example, in the domain of design, the focus has been how affordances can be created by designers to better address individual needs by enabling users' possibilities and constraining their choices (Gaver 1991). In a related way, the notion of affordances has become popular in technology and innovation studies to make sense of human relationships with our new technologies. Popularized in the human computing interaction research by Norman (1988) who defined affordances as the design aspect of primarily the fundamental properties of an object, this characterization argues that materialities of technological artifacts matter significantly as it prescribes how objects should be used. Yet affordances do not exist independently as people encounter materiality with diverse goals and perceive a technology as offering distinct pathways for action. In times of change, designers can strive to communicate about the capabilities of digital hardware and software to users through its affordances and additionally through information on or in the artifact about the affordances (Burlamaqui and Dong 2015).

Given how new electronic technologies and digitalized texts may offer new enablements in mediating social interactions, Hutchby (2001, 44) noted in *Technologies, texts and affordances*, that "[a]ffordances are functional and relational aspects, which frame, while not determining, the possibilities for agentic action in relation to an object". These possibilities generate action in situ, but are finite and relatively stable since material features of digital devices place confines

on the types of interpretations people can form and its applications in specific socio-cultural and organizational settings (Leonardi 2011).

As our environments are reconfigured with the diffusion of mobile and social media, communication scholars have sought to explicate communicative affordances and identify new sets of affordances. According to Schrock (2015, 1232), "[c]ommunicative affordances are defined as an interaction between subjective perceptions of utility and objective qualities of the technology that alter communicative practices or habits". In this conception, affordances inherently involve communication as they are "evaluated through communication and successively alter communicative practices" (Schrock 2015, 1232) in everyday mediated connections, framing "practices through which technologies come to be involved in the weave of ordinary conduct" (Hutchby 2001, 450). Besides its quotidian nature, a communicative affordances approach focuses on the implications of new technology beyond technical features or operating systems as they exist at a higher level of abstraction and application (e.g. Evans et al. 2016; Schrock 2015). In this way, recognizing the "high-level affordances" (Bucher and Helmond 2017) and multidimensional nature of affordances allows us to "ask questions about how different technologies may facilitate similar affordances, how similar technologies may facilitate different affordances, and how variations in affordances may lead to different outcomes" (Evans et al. 2016, 47).

Furthermore, while affordances link the capabilities of technological artifacts to users' purposes (Faraj and Azad 2012), they also constrain and limit, making it "possible to do it one way, but not another" (Hutchby and Barnett 2005, 151). As such, constraints are not necessarily always construed in negative terms as they act as "the conditions and relationships amongst attributes which provide structure and guidance for the course of actions" (Kennewell 2001, 106). In this vein, constraints are by no means "the opposite of affordances; they are complementary, and equally necessary for activity to take place", particularly for teaching and learning using digital communication technology (Kennewell 2001, 106). Therefore, while constraints are often treated separately from affordances for analytical purposes, they operate in concert and should be assessed to obtain a fuller picture of the potential of new technology and dynamics of technologically occasioned social change.

Variants of Communicative Affordances and Constraints for Spiritual Robotics

For the purposes of this paper, examining communication affordances and constraints provides an inroad to considering the routine or habitual use of robotic agents to accomplish certain spiritual goals. As Schrock (2015, 1233) pointed out, "the perception of utility is developed in relation to goals" and

"communicative affordances likely do not create the goal an individual is trying to achieve … they enable a new way to accomplish it." Prior studies have identified varying sets of communicative affordances specific to mobile and social media as a way of describing how mobile devices impact communicative practices and outcomes (Boyd 2010; Schrock 2015). These previously identified affordances are related to the differential capabilities of spiritual robots with mobile and tablet interfaces and can thereby inform how the robot XE is used to fulfill distinctive spiritual goals.

For instance, the mobile phone and instant messaging applications has been described as facilitating 'perpetual contact' (Katz and Aakhus 2002) enabled by the affordances of availability and portability where users act as communicative hubs across various contexts of daily life (Helles 2013). The affordances of availability or full-time 'anywhere, anytime' access to peers among children and teenagers in European countries (Mascheroni and Vincent 2016, 321) were found to advance "diverse communication possibilities, which shape distinctive communication practices as well as different norms covering use, social expectations and emotions around smartphones." In addition to the communicative affordances of availability and portability, Schrock (2015) has pointed out that the affordances of mobile phones include locatability and multimediality. The former referred to how location based services or GPS (global positioning system) on mobile devices deliver new ways for individuals to form relationships and participate in place-making activities while the latter referred to the multimedia possibilities for taking photos and videos with mobile phones now outfitted with higher quality cameras.

In the related area of research on social networking sites, social media have also been analyzed in terms of having affordances and constraints (e.g. Boyd 2010; Ellison and Vitak 2015). For example, social network sites have been characterized by four key affordances of persistence (online expressions are automatically recorded and archived), replicability (enabling content duplication), scalability (heightened visibility of content in networks) and searchability (content accessible via online search) which structure users to engage as networked publics (Boyd 2010, 46). Comparably, Treem and Leonardi (2013) described four affordances of social media in organizational settings. These affordances were visibility, editability, persistence and association, which shaped organizational communication processes like corporate presentations, information gathering and social networking through social ties expressed through wiki and blog contributions or tagging of an article. In their review of communication affordances, Evans et al. (2016) proposed various criteria to clarify the scope of communication affordances; conceptualized as a) having gradations or range, and b) are neither the feature or the object, c) nor the outcome. Applying this threefold criteria, they explicated three examples of communicative affordances of social media which included

anonymity (degree to which the message source is perceived as unknown or unspecified), visibility (extent and ease to which data can be located), and persistence (level of accessibility to information and durability of data beyond its initial display).

More recently, Bucher and Helmond (2017) extended the discussion of the affordances of social media platforms to how properties of interfaces help (re)produce and make visible particular relations for end-users, software developers and advertisers. They highlighted how the affordances of adaptability and extendibility of social media platforms can facilitate content growth and personalization by and/or for end-users with algorithmically responsive and customizable interfaces that are integrated with other platforms and services to enable and constrain users' social media connections. Last but not least, communication researchers have also lately proposed that robots be treated as media objects operant in broader digital materialities where communication affordances are constituted. Berriman and Mascheroni (2018) discussed three affordances that robot toys share with other mobile media. These communicative affordances were liveliness, affective stickiness and portability, which were observed to be emerging through children's' interactions with 'smart care' robots.

To sum up the foregoing review, the concept of affordances has seen a resurgence of interest with the rise of digital and robotic media, providing robust explanations for understanding new technological artifacts that transcend its novelty, material object or deterministic outcomes. In recent years, the communication affordance framework has emphasized the inherent role of communication in framing mediated practices in everyday life, offering an interesting vantage point for exploring how contemporary robotics not only invite certain actions but also suggests constraints embedded in particular contexts rendering action. Yet scarce scholarly attention has been paid to exploring the communicative affordances of robotic agents for accomplishing religious goals. Hence, to fill this knowledge gap, this paper is guided by the following research question, "What are the key communicative affordances and constraints of robotic agents for enabling spiritual knowledge and community?" In what follows, this paper will discuss the case study before explicating key communicative affordances.

A Case Study Approach to Understanding Emerging Spirituality and Robotics

To broaden knowledge of emerging social phenomenon, case studies research provide rich contextual data to understand the values, beliefs and processes underlying contemporary events within their real-life contexts (Yin 2017). In light of the relatively new construction of spiritual robots, this case study provides empirical grounding and allows us to develop a higher level of

conceptual validity (George et al. 2005) on notions of communicative affordances and constraints as reflected by AI adoption amid China's sociocultural context. Apart from multiple studies which have established the advantages of case study research to reveal complex relations between AI & culture (Šabanović 2014), case studies in edited volumes of Buddhism and digital technology (e.g. Grieve and Veidlinger 2014; Travagnin 2016) have documented the strong potential of the case study approach to illuminate issues related to mediated technologies in the spiritual domain. Here as we seek to deepen understanding of AI and the possibilities for virtuous action, the recent and highly publicized case of XE was selected for intrinsic interest (Stake 1995) to yield maximum heuristic content (Flyvbjerg 2006) for advancing spiritual knowledge and practice through a rich descriptive account of the phenomenon.

Following principles for creating a valid case study database, the research team of bilingual Asian scholars drew upon multiple sources of evidence to develop converging lines of inquiry via a process of data triangulation (Yin 2017). Since vital information may not be readily available in one medium or within China's highly regulated media milieu, a thorough review of documentary evidence was conducted, including over 100 hours of ethnographic observations of Chinese and English video, audio and textual content ranging from news reports, magazines, films, websites, public forums to social media sites, within China and abroad, so as to obtain a more holistic picture of XE's development. To build more in-depth familiarity, interactions with XE in the Longquan monastery and interviews with ten priests and volunteers were conducted.

Through close engagement and careful process-tracing of our chronologically cataloged print sources, field notes and electronic records (George et al. 2005), we documented how reports of XE unfolded and developed a reliable account of XE's development. Keeping in mind the theoretical construct of affordances, iterative processes of theory-driven and data-driven coding of the texts led to the establishment of key and sub-themes (Charmaz 2006) corresponding to the communicative affordances of XE to answer the research question. Triangulation of observations from multiple data sources and reiterative reviews contributed to the verification of the interpretations presented (Yin 2017). This process, driven by our conceptual question, led to the identification of the four key communicative affordances of XE based upon established criteria (Evans et al. 2016), which are explicated and illustrated below. When citing quotations from the sources, we have included the pinyin Romanization of key phrases in brackets for reference, and reproduced the original meaning of the contents as faithfully as possible when their primary language was in Chinese.

The Case and Context: Humanistic Buddhism in China

The nomenclature of Xian'Er the robot monk (XE), like many names in the Chinese culture, carry significant meaning and emotional valence. Xian means virtuous and Er means dumb but Er also functions as a term of endearment. XE was conceived by Master Xianfan, a monk and head of the comic and animation center at Longquan temple in 2013, in hopes of attracting non-Buddhists to the faith and preaching the Dharma in an inventive way, as an "innovative Buddhist spirit" (Sherwood 2016). Beginning its existence as a protagonist of a cartoon series, "Trouble, you seek for yourself", XE was introduced when the temple launched an account on China's Sina Weibo social media account (Whittaker 2015). Posing as the character of a young novice monk interacting with an erudite master monk, XE was used to explain intricate Buddhist concepts on its Weibo feed through simple and humorous illustrations, initially created by paints, calligraphy brushes and then later with clay, followed by computer animations. The temple's cartoons have since attracted hundreds of millions of viewers on Weibo, and comic books of XE have also been published. The robot monk XE was later developed in a collaboration between temple staff and volunteers, AI experts in Chinese universities and a technology company, and unveiled during the National Day Gala at Longquan monastery on October 1, 2015.

Master Xuecheng, the then chief abbot of Longquan temple, and President of the Buddhist Association of China, who oversaw the creation of XE, expressed in the preface of the book, *A Roaming AI Xian'er, the Robot Monk*, that XE "is an attempt which is made by Buddhist practitioners and scientific researchers together, to seek for the truth of our lives. There is a new way other than duality. We have the ability to go beyond duality, the conflicts, and the contradictions between the spiritual world and the physical world" (as quoted in Ke 2016). As such, XE represents an effort to address the spiritual problems of mankind, in adherence to the beliefs of humanistic Buddhism.

While Buddhist practice encompass multiple traditions and variants, the modern philosophy of Humanistic Buddhism advocates that Buddhism should play an active role in secular society and its teachings be put to use to improve material conditions, and alleviate spiritual poverty (Sun 2011). Under its doctrines, new contemporary ways of practicing Buddhism, including the development of robots aligned with scientific knowledge and rationality, are not inimical to faith tenets. Instead, technological innovations are another pathway of propagating Buddhist wisdom and achieving enlightenment since the ultimate goal is to transform and provide positive guidance for the secular world through purification and transcendence. In the words of Venerable Master Xue Cheng (2017), "[i]n the age of globalization, when humans have increasingly become a community of common destiny, Chinese Buddhism is willing to take the initiative to reconstruct world culture and

nurture new human civilization … . A true and living Dharma will be realized through this interaction and exchange with society." Specifically, XE is said to be "endowed with an appearance and significance richly informed by Buddhist culture", to "guide the upcoming era of artificial intelligence onto a healthy road that leads to spiritual insight."

Mainland China has welcomed Buddhism more than two thousand years ago, though China is an officially atheist country with a lack of documentation on official statistics. There are an estimated 245 million Buddhists, representing the world's largest Buddhist population (The Pew Research Center 2012). Scholars contend that Humanistic Buddhism has become a growing, contemporary movement, as its fluid convergence with digital media, and doctrine and practice of social engagement aligned with State and policy interests, is popular among the young, intellectual elites and urban residents seeking to integrate faith beliefs into their everyday lives (e.g. Cheong, Hwang, and Brummans 2014; Ke 2016). As China's Internet population is purportedly the largest in the world and interests in AI continues to grow (Xinhua 2018), developments in the nexus of technology and religion present a fertile context for the examination of the potential of AI for cultivating spiritual pedagogy. The next section discusses the key communicative affordances and constraints of XE.

The Communicative Affordances of Xian'Er the Robot Monk

Searchability

The communicative affordance of searchability refers to the potential accessibility of content through search (Boyd 2010), related to the visibility or extent and ease to which data can be located (Evans et al. 2016). In the case of XE, the affordance of searchability refers to the potential accessibility of spiritual content via voice search or a touch-screen tablet display on its tummy. XE can explain basic tenets of faith, answer spiritual inquiries drawing upon a database of questions built from Buddhist books, and all the questions and answers on the Abbot Master Xuecheng's blog, which was authored daily by the Abbot and maintained over ten years (personal communication June 20, 2018). Interactants can pose spontaneous questions to XE or they can refer to an evolving list of five questions featured on XE's tablet, for example, they can ask XE "Where are you from?"

These communicative mechanisms of XE's question and answer system enables XE to respond to supplicants' spiritually oriented questions, such as "What is the meaning of life?" and "Who is your Master"? The temple's robot development team found that most questions proposed to XE are about love, stress, annoyance and confusion in life (Xinhua 2018). By providing responses to peoples' questions via search, XE provides another avenue of

exposure to spiritual content and can facilitate human spiritual quests with real time and embodied engagement with XE among temple visitors. In this way, searchability made possible by XE helps support religious education beyond specialized classes, but which are still based on sacred scriptures and priestly teachings.

Yet searchability here also constrains the extent to which the Buddhist Dharma may be spread. By automating the search and response communication, the quality of responses to spiritual inquiries are bounded by XE's database capacity. The database is sizable with an input of more than 100,000 questions but nonetheless, is limited in terms of subject coverage, search range and time frame, depending on the repertoire of content input in the database by monks and volunteers. The responses also tend toward the concise, straightforward or factual answers which may represent the distillation of wisdom from sacred scriptures, rather than an in-depth debate or philosophical discussion. For example, when XE was asked the question, "how can we gain contentment and happiness?" XE's response was "we have to learn how to be grateful, give thanks, and cherish those around you, then you will be happy" (personal communication June 20, 2018). This brevity of response may aid or spur spiritual information gathering but may also deter more profound engagements with denser religious concepts and texts.

Moreover, XE's voice search function may pose as a constraint on XE's searchability of spiritual content due to the limitations of its natural language capacity to sustain a focused and clear conversation. Errors that are due often to misinterpretations affect the amount of information presented to interactants. For example, during our direct observations, there were several instances in which researchers' questions had to be repeated, and rephrased using different words multiple times to prompt XE toward a response. In one instance, the question "what do you least like to do?" was interpreted as "What do you like eating?". After a while, instead of speaking directly to XE, temple assistants brought out a small wireless device so that our voices could be amplified and communicated directly to XE. If XE did not comprehend a search, he replied with canned responses, like "Please repeat", "Please continue" and "Let me ask my Master (Shifu)". Thus, some have expressed disappointment with XE in this aspect. One of the volunteers at the animation center shared that XE's "search technique is not too great" (jishu bu zheme yang) as it still does not understand many commands and thus is "not that impressive yet" but stressed that this was her own assessment (personal communication June 20, 2018). It is also significant to note here that at the time of the investigation, XE the robot could only respond primarily in the Chinese language, though it spoke a few words in English (e.g. I love you). Although efforts are being undertaken to upgrade and develop XE's multilingual language capacities, searchability of religious content is curtailed by language limits, particularly for international visitors of the temple.

Multimediality

The communicative affordance of multimediality involves the incorporation of multiple media capacities (Schrock 2015), here including access to sacred texts but also visual images, temple bell sounds, and a countdown timer for mediation. XE can also sing Buddhist songs, chant mantras and its vocalizations provide an aural environment to support spiritual awareness and contemplation. Under Buddhist musical traditions, XE's integration of sonic worship practices corresponds to mindfulness and change (Greene and Wei 2004) as believers experience truth through scriptures, which are made relevant through ritual music and focused reflection. Digitalized meditation timers that end with a gentle sound, like the one provided by XE, can also help practitioners focus their attention and structure their meditation session.

However, background noise interference may mar the multimedial experience of XE's vocal and instrumental transmissions. For meditation to work, Buddhist practitioners typically require a quiet environment, undisturbed by ambient noise and people walking, but such conditions may not be possible to achieve in the temple's animation center. In light of the temple's and XE's popularity, the animation center is often busy, impeding meditative practices of stillness and focused breathing.

Furthermore, though the multimediality of XE can facilitate self-meditation, religious leaders are quick to point out that XE cannot replace the role of the priest in guiding meditative practice, "as it does not have a soul, so it cannot provide soul care." A senior priest asserted that because robots do not have inner spiritual experiences, compassion and self consciousness, XE "cannot spiritually guide others" toward enlightenment (personal communication June 20, 2018). Moreover, as the temple offer daily meditation classes in quiet retreat and enclosed settings in other parts of the temple grounds, the application of XE's multimediality appear to have limited appeal for extended meditation. In this way, instead of cultivating connectivity and advancing transcendental experiences, this communicative affordance of XE may have a relatively small range to affect localized spiritual practice. On the other hand, the musical outputs of XE can be entertaining, furthering its role as a temple host, as discussed in the next section.

Liveliness

The communicative affordance of liveliness involves multi-way exchanges of information or joint dialogue with robots that evoke life-like speech and movement without apparent human control (Berriman and Mascheroni 2018). According to a lead monk, XE's liveliness enacted via vocal and physical interactivity furthers its role as a "temple assistant" (ju shou) to guide and entertain temple visitors (personal communication June 20, 2018).

XE's facial and object recognition features enable him to remember prior interactants and tailor conversations based on former discussion. Beyond overt spiritual queries, XE can also maintain simple conversations about everyday concerns like the weather (e.g. respond to questions about the air quality) and make jovial, small talk regarding user emotions (e.g. I am not happy, calmness is good).

XE's liveliness is also associated with its traversability as its wheeled mobile navigation, range sensing ability and vision sensors help it respond to a handful of voice commands to move. Users can also refer to XE's tummy tablet, for a list of actions that XE can be "directed to perform" (zhi hui wo), including to look left or right, move forward or turn left, or right. XE can dance or twist its body (niu yi niu), light up its eyes, and also shake its head if one rubs his ears. Spiritual aphorisms are dispensed before certain actions, for example, upon comprehending a voice command to move forward, XE says, "you must look forward, then your life will be full of hope" (personal communication June 20, 2018).

In the above ways, XE's liveliness enabled by user interactivity in multiple forms of informal, even entertaining encounters helps improve its hospitality with new visitors and spiritual seekers, without intimidating them. Furthermore, like many smart toy devices, XE does not assume a convincing humanoid form but is more aptly characterized by its "cuteness", a factor in social robotics which has helped encourage mutual care and socialization (Gn 2016). Significantly, it is noted that XE has multiple anthromorphic features that have been identified as key to enhancing robotic cuteness (Gn 2016), including a big round head, wide eyes, a slight smile and a puzzled look on his face. He sports the iconic saffron colored robes and a shaved head of a monk but is miniaturized to two feet tall. He is voiced by a childlike voice that belongs to a nine-year-old boy. As XE's liveliness may prompt interactants to share more personal information, and be more forthcoming with their responses, interaction with XE may appeal to those who have little interest or familiarity with religion.

Remarkably, prior news reports have highlighted XE's liveliness as a major magnet for temple visitors. For example, it was reported that Liu, a college student who is not a Buddhist, went to the temple to meet and pose for pictures with XE, said, "Its super cute … .I feel it is like a temple mascot, making Buddhism much more accessible" (Lu and Robertson 2016). Yu, a practicing Buddhist and tourist to the temple said, "He looks really cute and adorable. He'll spread Buddhism to more people, since they will think he's very interesting, and will make them really want to understand Buddhism." (Andrews 2016). According to Ke (2016), the lively interactivity supported by XE is attractive to the visitors to Longquan's animation center, especially children and young adults who are drawn to XE's adorable and comforting interface. He had observed that, "[e]very weekend and holidays,

the animation center is full of visitors, especially children and young peoples. The first question they ask when they step into the room is always the same, where is Xian'er?" It was really touching that I saw a toddler put his hands together in prayer when he saw Robot Xian'er for the first time." A volunteer of the publicity department of the temple also said that "she has an optimistic view" of XE after noticing how a visitor with a background in AI after some animated conversations with XE "smiled and was very happy", which made her think how one day, "the publicity department will not longer be needed" (personal communication June 20, 2018).

Yet it is worth noting how XE's vocal and physical action possibilities are constrained in light of its short battery span. Upon questioning, temple assistants could not state how long XE could function after one full charge (the time may also vary widely based on the actions performed). One volunteer in the animation center said that XE "does not last that long" (personal communication June 20, 2018). It was also observed that XE's status battery level moved rather quickly to depletion, and XE could not perform his physical acts if its battery charge dipped below twenty percent, at which point, XE would say, it needed to refuel. Furthermore, as anthromorphic features on social robots may lead to higher expectations of interactivity (Gn 2016), XE's limited mobility, and lack of other expressive facial features may underwhelm some interactants seeking to communicate more intensely with XE or engage with XE over different spaces, for example, traversing over unevenly paved stone paths on temple grounds.

Extendibility

Extendibility refers to the communicative spread of information across platforms and programmable integration of linked data from multiple sources to multiple stakeholders within the logics of media convergence (Bucher and Helmond 2018). In the case of XE, temple monks and volunteers have been working to expand XE's presence and integrate XE's online and offline communications on the temple's social media account, its chatbot app, and XE's embodied interactions into one "big brain" (Da Nao). In this respect, a temple monk stressed that beyond the attractive presence of XE, the more important development here is the digitalization of sacred Buddhist texts and the updating of previous translations into modern idioms by temple monks working with machine learning, because XE the robot monk and its chatbot counterpart rely on this big database. The chatbot utilizes the same childlike voice as the robot XE. With this transmediation of spiritual content across communication platforms, users and seekers can access and communicate with XE face to face, or virtually at anytime beyond temple grounds.

The extendibility of XE was prominently promoted in the temple, illustrating how designers can communicate about the capabilities of digital

hardware and software to users through its affordances and additionally through information on or around the artifact about the affordances (Burlamaqui and Dong 2015). Here, it was observed that various messages were placed in the animation center and around XE, including large colored posters placed on stands that announced how one can communicate with a "3D" version of XE online via "24 hours interaction", as XE can provide "counseling on your troubles, and share spiritual knowledge" (Kai jie fan nao, zhi hui xing ling). In addition, namecards and posters featuring QR (quick response) codes highlighted how interested parties can connect and scan to obtain access to XE's chatbot. In this way, the communicative affordance of XE's extendibility allows for interoperable data exchanges, to facilitate new forms of networked associations to expand the reach of XE to larger audiences, enlarging the scope of its spiritual influence.

Extendibility is also key for "religious branding" (Einstein 2011) as the consolidation of repeated symbols of XE across mediated platforms advances its status as a cultural and religious icon, to attract attention to Buddhism. It was observed that pictures of XE are found all over the temple, including those printed on the wooden signs pointing directions to different temple locations, like the library, worship hall, and cafeteria. Thus, by showcasing XE at different points of contact and facilitating strategic discursive access to XE on affiliated channels, extendibility can help build religious conversations and organizational loyalty to the temple, enable relations among users, and strengthen faith devotion.

Yet the other side of extendibility concerns the limits to which XE's presence can be deployed and activated. Connectivity to the physical XE is managed by temple staff and volunteers, who act as informational gatekeepers as they watchfully chaperone XE during temple visits. Scheduling direct observation and interactions with XE is challenging, in part due to the hectic schedule of the temple workers, for example, staff from the New York Times were not granted access to XE for their temple coverage as XE was reportedly being prepared for another audience (Tatlow 2016). XE does not make public appearances at Longquan temple often as he spends most of his time "meditating" in a broom closet where he is stored to recharge his energy. As such, the range of XE's extendibility is moderated by temple regulation and its strategic management of XE access.

Conclusion

As the rash of publicity on AI and influence of social robotics expands in everyday action globally, commentators have voiced the importance of heightening consciousness on the beneficial development of AI to include a broader perspective, particularly a spiritual one (e.g. see Varvaloucas 2018). In this paper, we explored the development of a Buddhist robotic agent, and made several contributions to the literature and interdisciplinary understanding of AI.

First, this paper applied the concept of communicative affordance to AI to focus attention not on any particular mechanical feature, but on the new spiritual dynamics and types of communicative practices that various features of XE afford. Four communicative affordances were identified and explicated, including searchability, multimediality, liveliness, and extendibility. These affordances fit established criteria for communicative affordances (Evans et al. 2016) as data illustrated how these affordances are neither XE's features, nor are outcomes, and have variability or range. Thus, key affordances described here resonate to a certain extent to those identified in prior research on digital mobile and social media technologies. These similarities enable us to trace the continuities in how outwardly distinct and different digitalized devices may facilitate similar communicative affordances. For example, searchability affords information seeking and sharing of religious knowledge among religious followers and seekers, and multimediality facilitates the broadcast of spiritual hymns and mantras. In this way, understanding the key communicative affordances of spiritual robots like XE enables faith leaders and laity to value and compare its potential to work with existing devices within mediated organizational contexts, or be possibly integrated into everyday routines. In addition, the affordances explicated here also highlight how new social robotics may facilitate new or different variations in affordances associated with different outcomes. For instance, the liveliness of XE enabled by user interactivity with the suite of XE's cute vocal and physical features may elicit extended dialogue and spark interest in spirituality among religious seekers. Traversability which rests within the liveliness affordance also adds granularity to the understanding of spiritual hospitality, as XE's wheeled mobile navigation and sensors are directed toward user engagement to support its role as a temple assistant and host.

Second, corresponding with discussions of communicative action possibilities, this paper also provided discussions of constraints and accompanying contextual limitations of XE's operations. How affordances link capabilities of technological artifacts to users' purposes has received far more attention than the ways in which they also curb and limit possibilities. As such, descriptive documentation here on how affordances may curtail a course of spiritual action within a specific locale, contributes to deepening conceptual understanding of communicative affordances. Thus, beyond circumstantial case study findings, this analysis provides heuristic insights for theorizing emerging robotics, from a middle ground perspective that accounts for how the materiality of XE's operating system and platforms enable specific communication opportunities and how people can engage with recognizable spiritual practices for knowledge and community building.

Third, as popular imaginaries of AI applications accompany abstract and broad predictions of seismic societal shifts, this study provided a rich descriptive account to help understand the complex nature of human-

machine interaction with more clarity and sensitivity to context. This work is significant because AI in the religious domain is an understudied area. Social robotics in a non-western context, apart from Japan, is also scarcely understood (Geraci 2013). Thus, it is hoped that the case of XE contributes empirical grounding for future consideration of the possibilities and challenges of robotic agents in the advancement of moral growth and spiritual interests.

That said, it is acknowledged that more research is needed to understand how transferable this study's findings are to others for case comparison (Yin 2017). The affordances presented here are not exhaustive, particularly considering the reported plans to upgrade XE (Xinhua 2018) and how AI development is a moving target. Future studies should expand this exploratory line of research to more cases, and employ supplementary data collection methods and analysis. For example, interviews with the monks and volunteers who help with the multilingual translations, and interviews with temple visitors could be conducted, in order to more fully comprehend the potential of robotic agents to support religious education and growth. Future papers could also explore in more detail how intensifying datafication and media convergence impact robotic engagement, for example, how evolving platforms, machine learning and algorithms structure "hidden affordances" of which users are unaware, or are less familiar with (Gaver 1991) regarding novel robotic applications for security or surveillance. With the expansion of robotics in more domains of everyday life including the practice of spirituality, research on the nexus of robotics and religion provides in both the literal and metaphorical sense, an enlightening pathway of understanding human welfare, morality and community amidst technological innovations.

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