Digital Memorialization in Death-Ridden Societies: How HCI Could Contribute to Death Rituals in Taiwan and Japan

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Abstract. Both Taiwan and Japan are entering an area of hyper aged and death-ridden society. The death rituals in both countries are rapidly changing due to urbanization and secularization, although both cultures have long histories and traditions for funeral and memorialization. Furthermore, some digital technologies have already been adopted in both countries, providing alternative changes for some occasions. This paper principally reports contemporary funeral and memorialization practices in Taipei and Tokyo by introducing insights from our fieldworks and interviews in both cities. These also include examples of digital technology adoption. Comprehensively understanding phenomena being caused by local faiths and traditions, we will discuss how ICT/HCI designers could contribute to the realm of local memorializations and more generally around the world, and what kind of design opportunities for the future death rituals they could be involved in.

Keywords: Death and HCI · Technology · Mourning · Funeral · Memorialization · Remembrance · Thanatosensitive design · Taiwan · Japan

1 Introduction

Both Taiwan and Japan are becoming hyper aged societies. This means that not only the population of elderly people, but also the number of deaths are rapidly increasing. Around 2040, it is said that the annual number of death in Japan will be the highest since after the WWII.[1] While although Taiwan is little bit

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[1] In 2016, the number of death was around 1.3 million, but it is estimated to be 1.68 million in 2039 [1].

behind Japan on the aging, its crude death rate in 2050 will be almost twice than today.[2] With the coming of death-ridden societies in both countries, ritual practices and people's thoughts on memorialization are also rapidly shifting.

Each country is a small island and has intense density of population in the city area, particularly Taipei and Tokyo. Although Taiwan and Japan are geographically close and influence one another, the religious and local customs are slightly different (e.g. [3–6]). Funerals and the other memorialization rituals in Tokyo, mostly based on Japanese Buddhism, are becoming more and more simplified in the last decade (e.g. [4,6,7]). Japan has a relatively long history of cremation and today, where over 99.9% of bodies are cremated [7].

In contrast, Taiwanese people more rigorously follow traditions based on Taoism, Feng Shui, and some local traditions (e.g. [5,6,8]). Even though people historically have practiced traditional burial and reburial rituals, which in total takes 6 to 7 years, they have now adopted cremation in the last decade. Today, over 95% of Taiwanese are cremated.[3] With increased cremation and the urbanization of memorialization practices, Taiwanese funerals and subsequent memorial practices in the city area are also rapidly changing. Since the shift to cremation in Taiwan occurred over a relatively short period of less than 30 years, Taiwanese people are more conservative and still keep to tradition [6] compared to Japan, where rituals are becoming more diverse and even simplified. But Taiwan and Japan share some ritual artifacts in common such as flower, incense, the mortuary tablet, coffin, urn, photography, and etc.

On the other hand, people in both countries are rapidly adopting Information and Communication Technologies (hereafter 'ICTs') not only in their daily life, but also in their memorialization practices. For example, there have been digital photo frames on the altars in funeral halls in Taipei since almost 10 years ago, according to our fieldwork described below. There are several online memorialization web services produced in Taiwan.[4] Further, in some columbaria in Japan, digital displays show the deceased's photos and his/her life data [12]. The question of how to utilize technologies in designing memorialization experiences is becoming a key issue in both countries.

Addressing this situation, this paper focuses on seeking how the deceased's memory and presence could be digitally archived, utilized, and inherited by the next generation within a hyper aged and soon-to-be death-ridden society. After briefly introducing traditional death rituals in Taiwan and Japan, we first examine the existing academic and case reports on digital commemoration. We then examine several websites—mostly hosted by funeral companies—to analyze contemporary funerary rituals and practices. These provide instructive visuals, text, and videos for customers. To support this analysis, we visited practical sites in both countries including funeral halls, cemeteries, columbaria, and related

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[2] While the crude death rate was 7.5% in 2018, it is estimated to be 15% in 2050 [2].

[3] In 1993, the percentage of cremation in Taiwan was 45%, but it was 96% in 2017 [9].

[4] For example, a "Cloud Remembrance Platform System" was launched by Kaohsiung City on January 16, 2018 [10]. In a columbarium, a similar service using QR code has been commercialized [11].

expos. Occasionally and whenever needed, we interviewed people who work at these sites in order to understand contemporary rituals in Taipei and Tokyo.

Reviewing and analyzing these data, we describe the basic scheme of funeral procedures each in Taipei and Tokyo, and what kind of both analog and digital objects—related to the deceased—have been adopted. Holistically addressing these phenomena, we will discuss what kind of design opportunities there are for either archiving or utilizing the digital remains for/in the memorialization practices. Especially, we focus on discussing how people in the death-ridden societies could prepare for their deaths and what kind of technology-enabled designs are required by those who will encounter a death-ridden society. Finally, we will argue how ICT/HCI designers and creators handle people's memories in the sensitive contexts especially related with the death rituals in general, by learning from this research.

2   Background and Related Works

2.1   Key Objects for Memorialization in Taiwan and Japan

Over hundreds of years in Japan, cremated remains (cremains) have been highly appreciated and protected. Since cremation became popular from the late of 19th Century to 20th Century, people have favored constructing family gravesites in which multiple urns were stored over generations (e.g. [3]).

On comparison, the cremation history of Taiwan is shorter than Japan. Traditionally, the Taiwanese have also appreciated the dead's bones through the unique burial custom known as bone washing (撿骨) ritual. However, due to rapid urbanization and limited land for gravesites, Taipei city local government has promoted cremation to its citizen and built many public columbaria in the last 30 years (e.g. [8,13]).

Since the 1990s, customs and rituals for burial and disposal in Japan rapidly begun to change. Natural burials, defined in Japan as a means of interring cremains, such as the tree burial (directly placing ashes in the ground) and the sea burial (scattering ashes at the sea) has spread through society, as people who are unmarried or without children faced difficulties in keeping and maintaining their family gravesites. (e.g. [14,15]) In recent years, cases of isolated death and unclaimed cremains have become well-known social problems [7], broadcasted by major newspapers and TV shows. Though the custom of natural burials has yet to spread throughout Japanese society, memorial rituals are gradually shifting toward natural burials and other alternatives.

In Taiwan, Taipei city local government has been promoting the natural burial methods: "tree burial," "flower burial," and "sea burial" as a means of the saving its limited land space [8,13]. However, a limited number of extremely wealthy people in Taipei still refuse to adopt cremation even though they have to pay a vast sum of money[5] in order to purchase a gravesite for burial [6].

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[5] Over ten million TWD: about three hundred thousand USD.

Fig. 1. *Temoto kuyo* products. Left: "*Mayudama*" [18], Middle & Right: "TORUS" [19]

In both Taiwan and Japan, the spirit tablet or mortuary tablet—*páiwèi* (牌位) in Taiwanese and *ihai* (位牌) in Japanese—has been interpreted as one of most important items involved in memorialization practices. Traditionally in Taiwan, *páiwèi* is initially made of paper by the Taoism master at the funeral, and after one year, is replaced by one made of wood for the bereaved family's home altar [5,6]. Contrastively, Japanese *ihai* is inscribed with a Buddhist posthumous name *kaimyo* (戒名)[6] and used at the funeral and domestic memorial customs at Buddhist altars (e.g. [3,16,17]). Similar to Taiwan, *ihai* is initially made of a light wood by the Buddhist priest, but 49 days after the dead, it is replaced by one formally made of wood stained with Japanese lacquer that is placed at the home altar. During the period when the deceased in Taiwan is represented by a paper tablet (one year), the bereaved family has to take care of him/her, offering incense and food every day. Otherwise, it is said the hungry ancestor will became a "ghost" who brings his/her decedents misfortunes and troubles [5,6]. In comparison to Taiwan, Japanese faiths and rituals for the spirit tablet *ihai* are relatively informal and becoming increasingly secularized especially for the younger generations.

2.2   Secularization, "Bodiless" Memorial, and Digitalization

According to contemporary research of Japan, several artifacts are taking over the *ihai* in ritual and informal settings. Suzuki [16] reports that many of Japanese families display framed photographs of the deceased or *iei* (遺影) instead of *ihai*. People who adopt "*temoto kuyo* (手元供養)"—a way of keeping ashes (cremains) stored in micro-containers or urns at home[7] —(e.g. [14]) usually display their

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[6] Except the Buddhist school of *Jōdo-Sinshū* (浄土真宗) that gives the deceased a *hōmyo* (法名) or precept name during their lifetime, and does not make *ihai*.

[7] For example, a product—consisting of small urn and items for Japanese styled memorialization: incense tray, candle holder, *rin* (Buddhist instrument), and flower vase— has been marketed (Left on Fig. 1). Jewelry in which ashes can be inserted has been also produced by several Japanese companies (e.g. Middle and Right on Fig. 1).

temoto kuyo urns at home along with the deceased's portrait. Some still use *ihais* but some have thrown such traditional ritual items away.

Furthermore, in several cases photos used in memorialization practices have been digitalized, which can shift the meaning and value of such displays. New style columbaria known-as Automatic Conveyor-belt Columbaria (ACC) located in urbanized areas of Japan adopt digital displays of *iei* picture, *kaimyo*, and the other information about the deceased [12]. Gould et al. [17] describe contemporary secularizations of domestic memorialization rituals in Japan and introduce some digitalized Buddhist altar (*butsudan*) examples. An online *butsudan* service called Onra'in described in this article appears like a digitalized *butsudan* and virtually displays a family's *ihai*. Yet it also archives and shows pictures of/about the deceased, which technically more closely resembles online photo archiving services such as Google Photos [20].

Outside of Japan, death rituals including funeral, burial, disposal, and memorialization have been rapidly changed and secularized. Cann argues in her book [21] that memorial practices in the United States have been "bodiless," as people do not face the corpse or the nature of death given the rise of embalming and cremation throughout 20th Century. She claims people are now shifting to adopt "virtual afterlives" enabled by online memorial services and SNS on which the deceased could be represented again, although they are hidden from the rest of the (offline) world. Similarly, Arnold et al. [22] investigates how people mourn, commemorate, and interact with the dead through digital media, reviewing existing digital memorial platforms with a series of case studies drawn from North America, Europe, and Australia.

Of particular note are SNS such as Facebook and Instagram, which allow people to utilize several contents and services specialized for memorialization. Facebook provides "Memorialized Accounts" [23], a function that enables a particular user account belonging to the dead to be closed or changed to become an online memorial platform. (e.g. [24–27]) On Facebook, a service called "Legacy Contact" has been released. With it, a living user can appoint another as a Legacy Contact who has responsibility to manage the account in case of his/her death. [27] In another novel use of social media, Gibbs [25] surveyed photographs shared on Instagram public profiles tagged with "#funeral" and revealed how the users have already invented new but vernacular rituals for the context of death, mourning, and memorialization.

Especially in the West, several scholars have begun to study how digital technologies shape the presence of the dead in the society. (e.g. [21, 22, 24–26]) As Cann [21] pointed out, the presence of the dead has represented online while traditional death rituals (mostly based on religious thought) are simplified and secularized. Notably in the urbanized regions including Taipei and Tokyo, physical spaces for graveyard has been almost exhausted. This is the realm in which digital technology has already intervened and emerging technologies may contribute.

2.3   Death and HCI

Especially within the HCI (Human Computer Interaction) research community, there has been growing interest in how interactive technology intersects with experiences of bereavement and memorialization. For example, some systems working on smart phones have been installed in cemeteries or graveyards. Gotved [28] surveyed QR codes on gravestones in Denmark and revealed how people adopt a digital memorial culture as provided by the QR code cemeteries which connect physical sites with virtual memories. Now both in Japan (e.g. [29]) and Taiwan (e.g. [11]), there are also commercialized graveyards or columbaria utilizing QR code identification. Simultaneously, Häkkilä et al. [30] designed a location-aware navigation application at a graveyard. Also in Japan, similar smart phone applications have been released (e.g. [31]).

Massimi and others [32] argue "thanatosensitive design"—design that engages with the many issues bound to mortality, dying, and death through the creation of interactive systems—is a critical emerging area for HCI research and practice. Foong and Kera [33] adopt a reflective design lens [34] to interpreting experiences of digital memorials. The first author in this paper Uriu et al. [35] proposed a digital family shrine concept for people to remember deceased relatives. Following this work, Uriu and Okude [36] describe an interactive altar with the candle flame called "ThanatoFenestra" for supporting ritual prayer for one's ancestors. Applying and evolving its concept, Uriu and Odom [37] proposed an interactive altar called "Fenestra" and conducted deployment studies in domestic environments. They and others [38] are also trying to utilize incense smoke for memorialization practices. Wallace et al. [39] suggested digital locket jewelry that enables a digital legacy to be archived along with particular narratives about the deceased.

Reviewing these examples and many others, Moncur and Kirk [40] offer a framework for designing digital memorials. They articulate the need for future research to explore how interactive systems shape practices related to the post-self—how the identity of the departed is socially constructed. They [41] actually designed "Story Shell" an interactive sound player working with a sound-gathering system, which is specialized for archiving and playing back stories about the deceased. Odom et al. [42] model the design of future technologies aimed at supporting a relationship between the living and the dead, reviewing the process of their works Fenestra [37] and Timecard [43]. Pitsillides [44] proposes how to create new forms of agency for the dead by arranging the digital legacies the deceased leaves. In order to make digital legacies have agencies or keep the dead's presence in the society, she points out how designers can combine digital legacies with physical and digital materialities such as ThanatoFenestra [36], Story Shell [41], digital locket [39], and etc.

As we described above, Taiwan and Japan share some of objects for funeral and memorialization rituals. However, due to limitations on land and secularization in cities, each country's traditions and rituals are shifting. Faster than in Taiwan, some alternative products such as *temoto kuyo* (e.g. [14]) and ACC [12] have already discovered new markets in Japan. In the West, digital/online

Fig. 2. Sunshine Life Memorial Hall (A: appearance, B: ceremony hall, C: columbarium floor, D: spirit tablet hall)

memorials are swiftly penetrating society, which illustrates existing ICTs have already been utilized for death related designs. We are now at the stage of exploring how emerging technologies within HCI could contribute to this realm.

Exploring contemporary cases in Taipei and Tokyo, this paper provides insight into multiple important topics of interdisciplinary concerns, identifying some design opportunities where ICT/HCI could successfully contribute. It proposes a set of future design directions to both Taiwanese and Japanese industries for funeral and memorial services, as well as what kind of topics the death related scholars should investigate, and how designers and engineers in the HCI community could collaborate with them.

3   Contemporary Funeral and Memorialization Practices

3.1   Methodology

This section consists of data captured in our field studies and interviews in both Taipei and Tokyo. In Taiwan, we had an opportunity to contact and visit Chin-PaoSan (金寶山) [45], established in 1977, which is one of the largest companies for memorial services in the country. It owns a huge region for cemeteries and columbaria in the north Taiwan area, and also provides funeral services in Taipei city at their funeral hall called ChinPaoXuan (金寶軒). The first field study, visiting their columbaria located in the north Taiwan area and ChinPaoXuan, was

Fig. 3. The funeral altars in the ChinPaoXuan hall.

conducted in 2016. After that, we had several opportunities to interview with their staff up until 2019. To understand Japanese landscape in 2019, we interviewed an individual working at funeral halls in Tokyo who actually conducts an array of funeral practices, including deciding funeral procedures with bereaved families, coordinating with Buddhist priests to hold rituals, and finally, working as an emcee at the funeral ceremonies. In addition to capturing these examples, we received some pictures taken at a funeral by a person who lost her grandmother in 2015. To comprehensively describe the situations in each city, we also refer to Web articles, films, media, and so on as necessary.

3.2 Taipei, Taiwan

Contemporary Funeral Procedure

One of ChinPaoSan's columbaria called "Sunshine Life Memorial Hall (日光苑)," architecturally resembles a Christian church and its interior is completely modern (Fig. 2). It holds memorial services within any religious and cultural backgrounds, such as Taoism, Buddhism, Christianity, and even none-religious. Before ChinPaoSan began to make columbaria in the latter part of 20th Century, Taiwanese columbaria were known to have a dark atmosphere with interiors that resembled simple storage facilities. Public columbaria today retain this design, but are available to everybody. Following the emergence of ChinPaoSan's columbaria, other companies also produced modern style columbaria in Taiwan, marketed especially to the wealthier people.

According to their website, the contemporary funeral service in Taipei is roughly divided into eight procedures, as below.[8]

(1) Hospice care
(2) Transport of the deceased
(3) Setting-up of the funeral hall
(4) Funeral coordination

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[8] https://www.memory.com.tw/en/education.php#process. The introduction video (Taiwanese) is also available on https://www.youtube.com/watch?v=i_l8lz8V1Ts.

Fig. 4. Left: An urn specially designed for Sunshine Life Memorial Hall (Fig. 2) produced by ChinPaoSan, Right: an urn prepared at an urn shop in Taipei city

(5) Encoffinment
(6) Offering ceremony
(7) Cremation, columbarium (Installment/Interment)
(8) Follow up care

In phase (1), when funeral staff are informed a person is dying soon, they begin to prepare a whole package for the funeral ceremony. Just after the person dies in phase (2), they collect the deceased's body and move it to a public mortuary facility. Then the (Taoism or Buddhist[9]) priest holds a ritual to transfer "the deceased's spirit" to a spirit tablet, while the body is frozen and kept until the day for encoffinment (5). Simultaneously, the funeral staff talk with the bereaved family to decide the details of the funeral plan (3). In Taiwan, the day for encoffinment (5) and the day for the offering (departure) ceremony (6) and the cremation/burial date (7) do not occur on a fixed timeline. These dates are individually decided according to "the good days" following Feng Shui and Taoism. In phase (4), the spirit tablet is placed on the altar in the funeral hall such as in Figs. 3 and 5. During the days leading up to for final offering (farewell) ceremony (6), the bereaved family and any guests may to visit the altar, which is usually approximately one week. The bereaved finally reencounter—the first time after it got frozen (2)—the deceased's body at the public funeral hall when the corpse is cremated in the encoffinment (5) and the final ceremony (6). It takes a few days during phases (5) and (6), accompanied with some religious and local rituals with priests. In phase (7), cremains in an urn are installed in the columbarium such as Sunshine Life Memorial Hall after a ceremony at the hall (e.g. Fig. 2B). Urns in Taiwan are normally made of stone[10] and engraved with the deceased's name, portrait, his/her birth place, and dates of his/her

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[9] In Taiwan, Catholic Christians also adopt the custom of spirit tablets, but Protestants do not.
[10] Commodity and cheaper one is made of marble stone but more expensive and highest quality one is made of jade stone.

Fig. 5. An actual example of a funeral altar layout (A: digital photo portrait, B: spirit tablet, C: offerings, D: messages and letters to the deceased, E: flower petals for visitors to be offered on the altar)

birth and death (Right of Fig. 4). After the package of funeral procedure, Chin-PaoSan focuses on following up with the bereaved family including grief care practices. The average duration from phase (2) to (7) is twenty days.

Rituals in Front of Funeral Altar

As shown in Fig. 5, the funeral altar consists of many objects. The digital monitor shows the portrait of the deceased in which multiple pictures can be stored and played as a slideshow. The spirit tablet is placed on the altar centrally with small dolls as servants to the deceased. Some offerings such as foods, drinks, snacks, flowers etc. are placed around it. Traditionally in Taiwan, during the period between death and the main ceremony, bereaved family members hold many local rituals (e.g. constantly offering incense sticks, performing "crying" whenever visitors come, and etc.)[11]. But nowadays in Taipei city, funeral companies have largely taken over these traditional rituals, corresponding with contemporary changes to people's working lives in the city area. At ChinPaoXuan, the staff offer foods and maintain the altars everyday, so the bereaved do not have to do anything. Yet, some of them frequently visit the altar and want to spend time with the deceased. For those visitors who would like to do something for the deceased, flower petals (Fig. 5B) and materials for writing letters (Fig. 5D)

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[11] A Taiwanese movie called "Seven Days in Heaven (父後七日)" illustrates these traditional rituals [46].
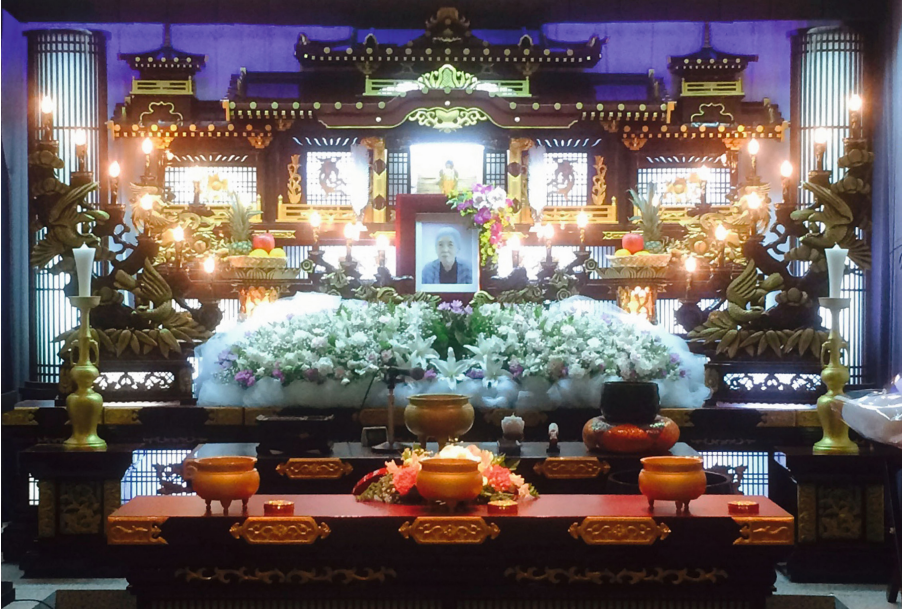
Fig. 6. A funeral altar layout at the hall located in near Tokyo

are available in the hall. Traditionally, Taiwanese people pray for or "talk" with the deceased via the incense sticks, but today the use of fire is prohibited inside the newer buildings by the law. During the days the altar is set up in the hall, normally 100–200 people visit the altar. However, there is rarely an encounter with the corpse in the contemporary funerals in Taipei city.

3.3   Tokyo, Japan

Contemporary Funeral Procedure
Japanese funeral procedure is shorter than in Taiwan, basically as a result of differences in local religious faiths and ritual traditions. Memorialization practices in Japan are mostly derived from Buddhism, but some local rituals appear more vernacular. As a reference, we will introduce the procedure described on a website by a funeral association group called Bellco [47]. Since funerals in Japan are becoming simplified especially in the city area, traditional rituals are sometimes shorten or skipped [4]. But the procedure below is still standard in Japan, even in Tokyo.[12]

 (i) Death and Transport of the deceased
 (ii) Consulting with bereaved family and funeral coordination
(iii) Encoffinment

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[12] Here is a set of explanations about Japanese funerals in English [48].

Fig. 7. Urns made of ceramic, commonly used in Japan

(iv) Night wake/memorial vigil
 (v) Farewell funeral ceremony and cremation
(vi) Follow up care

In phase (i), when a person dies, the bereaved family call the funeral company. Sooner than later, the staff from the company transport the body to the funeral hall.[13] In phase (ii), the staff introduce their funeral package plans to the bereaved, who have to decide on a plan, choosing from options. Then, the company and the deceased decide dates for the night wake (iv), the farewell ceremony, and cremation (v); by checking the crematorium's availability, the bereaved's schedule, the Japanese calendar's six labels called *rokuyo*[14], and availability of a Buddhist priest who holds a set of rituals. While in Taiwan the encoffinment (5) is scheduled at least one week later than death, in Japan the body is encoffined at the same day of night wake (iv) usually just a few days after death.[15] The funeral altar is set up in the funeral hall (e.g. Fig. 6) before the beginning of the wake (iv). At the same time, the encoffined body is placed in front of the altar. At the night wake, the priest comes and holds a set of rituals with the bereaved family and guests related with the deceased. All visitors burn incense chips for the deceased.[16] As with Taiwan, a white wooden spirit tablet called *ihai* (位牌) is commonly placed on the funeral altar, which is engraved with the deceased's

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[13] It was popular that the body is moved back to his or her home once from the hospital though final funeral ceremonies are held at the funeral hall. But today about 75% dead bodies are directly moved to the funeral hall.

[14] One of *rokuyo* labels *tomobiki* (友引) literally translates to "pulling a friend." Due to it's name, it is considered bad luck to schedule any funerals on these days. [49].

[15] A Japanese film called "*Okuribito*" [50] focused on the encoffinment specialist called *nokanshi* (納棺師). *Nokanshi* cleanses the body, lets it wear the burial outfit, and makes up the face, and encoffins it to the coffin with the bereaved family.

[16] The Japanese wake ritual originally means "the last night" with the deceased, hence the close relatives spend time together with the body until the morning. Nowadays in the city area, the night wake ends at 9pm.

Fig. 8. Left: a portrait of the deceased *iei* on the funeral altar, Right: Photos reminding of the deceased's memories displayed on an another altar in the funeral hall

posthumous name called "*kaimyo* (戒名)" given by the Buddhist priest. In phase (v), the final funeral ceremony is scheduled for 1.5–2 h prior to cremation. The priest holds some rituals and all visitors including the bereaved holds the incense ceremony again. After that, the bereaved family see the deceased for the last time. Then the body is moved to the crematorium and is cremated. After the cremation, the bereaved family members collaboratively pick up cremated bones and place them into an urn, usually made of white ceramics (Fig. 7). In Japan, installing the urn into the cemetery or columbarium should be scheduled for 49 days after death. Between the cremation and installation, the urn is generally stored at the bereaved's home. At the installation of the urn, the bereaved prepares a formal spirit tablet with the posthumous name engraved on it and asks the priest to hold a ritual to enshrine the spirit of the dead into the tablet.

Portrait of the Deceased, Use of Photos

A photographic portrait of the deceased is one of most important objects in a Japanese funeral. It is placed on the funeral altar throughout the night wake (iv) and the farewell ceremony (v). When the bereaved family accompany the deceased for cremation at the crematorium, one deceased family member brings this picture, called *iei* (遺影) (e.g. shown in the left of Fig. 8) as well as the *ihai* tablet. Both before and after the cremation, the *iei* portrait takes a key role in representing the deceased as an iconic presence. However, bereaved families have to find a photo of the deceased for an *iei* right after the death, despite being shocked and saddened by the loss. The *iei* picture—the image is cropped to the face and the original photo background is generally erased—has to be prepared for setting up the funeral altar before the night wake (iv) begins.

Corresponding to this need today, many *iei* portraits are systematically produced by on-demand workflows. Asukanet [51]—a pioneer company providing a remote *iei* production service—holds almost 30% of the market share in Japan. The bereaved family prepared a photo and pass it to the funeral staff. Then, the photo will be scanned and its data remotely sent to one of the photo editing centers run by Asukanet. A professional operator immediately edits the image, produces an *iei* picture, and sends it back to the funeral company. Finally, at

the funeral hall, the *iei* picture will be printed automatically. In some of funeral halls in Japan, digital monitors for displaying *iei* pictures are installed, but this is still not popular in Japan.

In contemporary funeral ceremonies in Japan, not only the *iei* picture but also other photos (snapshots) are displayed in the funeral hall. For example, shown on the left of Fig. 8, some photos are displayed on another altar close to the main funeral altar (Fig. 6) by the hall staff. These consist of photos of the deceased, ones taken with her family and relatives, ones of her last days taken by staff in a care home, and etc. Interestingly, in this case, another *iei* picture frame of her husband who had passed away previously was also displayed (to the right of the right image, Fig. 8).

4   Design Opportunities in Death-Ridden Societies

4.1   Presence of Spirit

People both in Taiwan and Japan have traditional faiths with rituals for honoring the "spirit" of the deceased. Although the details of the rituals are different between the two countries, spirit is mutually "installed" in the spirit tablet that is appreciated and inherited by the bereaved and their descendants. (e.g. [3,5,6]) While Taiwanese rituals around the tablet—and how to treat the dead spirit— are still relatively strict and there remains strong belief levels in its society [6], Japanese rites are gradually secularized with newer rituals (e.g. [14,16]). We cannot predict whether both traditions of spirit tablet rituals will continue or disappear in the future, but we might forecast that there will be something representing the dead's spirit in each country. Today, both Taiwanese and Japanese people believe in the presences (spirits) of the deceased and the ancestors, and perform memorial rituals for them (e.g. [3,6]).

In the West, some digital memorials on the Web have already been adopted by a number of people (e.g. [21,22]). But Cann [21] pointed out that the backgrounds of contemporary death rituals—secularized, simplified, and even artificially faded in the last decades—has ironically caused the rise of digital memorials. She emphasized how people in the West have reclaimed death rituals online.

This situation is different from Taiwan and Japan, having long histories of death rituals that appreciate the dead's spirit. It is possible that emerging new technologies will be adopted by both countries but existing rituals will not simply be digitalized nor replaced by the current online memorials. Both in Taiwan and Japan, some online memorials have already been commercialized (e.g. [10,11,29, 31]) but these are not the main rite for physical gravesites and columbaria, yet rather additional services. According to domestic reports in Taiwan, although the government is promoting online memorial services, which has not been accepted by elderly people while relatively approved by youth [52,53].

4.2   Alternative Rituals Required

Considering what kind of memorialization practices both Taiwanese and Japanese people need, one of key issues that emerges is the use of images. On

the funeral altar in ChinPaoXuan, there is a large digital monitor that displays portraits and snapshots of the deceased as slideshow (Fig. 5). These digital pictures in Taipei invoke the deceased's life memories, but do not have the strong presence of the deceased's spirit, which Japanese *iei* pictures (e.g. Left on Fig. 8) do. The *Iei* has come to occupy almost the same position as the spirit tablet in contemporary Japan—or even sometimes more important than the tablet [16]—during the funeral and following memorial practices. Displaying snapshots at the funeral such as shown in the right of Fig. 8, is a recent trend in Japan, that can be interpreted as similar to the digital slideshow at ChinPaoXuan.

As Pitsillides [44] has claimed, not only do images of the dead naturally remind the bereaved of the dead, but they could also assume a key role in manifesting the strong presence or agency of the deceased, with proper design. Particularly, emerging HCI technologies and their digital materialities (e.g. [36, 39, 41]) can be connected to digital legacies such as photographs. This integration would enable the realization of the agency or strong presence of the deceased.

4.3   What to Prepare for Your Death

Any digital legacies about a deceased person must be prepared before his/her death (though this may be changed through virtual modeling or realization technologies for/in Virtual Reality environment). Obviously, no one can support his/herself after your death. According to ChinPaoXuan staff, while some of the digital photo frames show a lot of pictures provided by the bereaved, some have only one or just a few, depending on the bereaved family. This suggests the importance of people in the digital age to store their life memories and package them in a way that can be inherited by their descendants. To this end, Asukanet [51] (the remote *iei* production pioneer) has an online photo archiving platform called "*Iei* Bank (遺影バンク)" [54]. It is designed for anyone who wants to choose a good portrait for *iei* by themselves and have it stored on the site. In addition to SNS such as Facebook, specialized services for memorialization are required that fit to local customs and rituals when preparing for death.

In the situation where traditional customs and rituals are shifting like in Japan, people are required to make decisions preparing for death; you have to choose your plans for the funeral, burial or disposal, and how the things you will leave should be treated. The term "*shū-katsu* (終活)"—activities of preparing your own death—is widely used especially amongst elderly people in Japan in recent years [55]. In *shū-katsu*, filling out the specially made templates called "*Ending Note*" is common. It consists of your wishes surrounding your death including the funeral, gravesite, legacies, and any other things which are not covered by legal will. In death-ridden society in general, the government or city cannot manage the performance of traditional death rituals due to limited space and secularization caused by changes to people's lives and working styles. The Japanese elderly have already begun to prepare for their own deaths within a context of diverse death rituals. With the increasing options of death rituals in the next decade, this shall also be a requirement for Taiwanese people. In the digital age, these activities for preparing for one's death also provides design opportunities with/on ICT/HCI.

5   Conclusion

Within our contemporary lives in urban areas, traditional death rituals held by local community previously are transferred to commercial memorialization companies. In the US, in the last few decades, local death rituals have faded away and the presence of death itself has become hidden from the society [21]. Both in Taipei and Tokyo, no bereaved family or relatives arrange funeral rituals by hand, as this is completely supported by the industry.

However, when participating in these fully supported and urbanized death rituals, some bereaved people might protest that there is nothing left to do by their own hands. Meeting these needs, ChinPaoXuan provides visitors with flower petal offering (Fig. 5B) and letter forms (Fig. 5D). In Japan, the common practice of the bereaved—filling the coffin with flower petals and inserting letters to the deceased—happens in the last minutes before moving to the crematorium phase (v). In addition, traditional fire rituals that involve candles and incenses are prohibited inside buildings by the local law, especially in the city area. We believe that emerging digital technologies could provide alternative rituals for people who want to do something for the deceased; at the funeral and also in the daily memorialization practices.

In this paper, we started with the question of how to utilize HCI technologies to support memorial practices, focused on contemporary funeral and memorialization rituals in (and preparing for) death-ridden societies, and reviewed examples in Taipei and Tokyo—more broadly Taiwan and Japan. Both countries have strong traditions of death rituals but have encountered situations that force them to change due to urbanization, secularization, and changes to living and working styles. Though people are forced to modify and sometimes simplify the traditions, there remain beliefs about the deceased and ancestors' spirits and its strong presences and agencies [44] in the daily life and culture. In death ridden societies in the digital age, designers and engineers have to engage with and support the local contexts and particular faiths behind the rituals, when utilizing emerging technologies.

References

1. Ministry of Health, Labour and Welfare, Japan: White Paper & Reports. https://www.mhlw.go.jp/english/wp/
2. National Development Council, Taiwan: Population Projections for the R.O.C. https://pop-proj.ndc.gov.tw/main_en/

3. Smith, R.J.: Ancestor Worship in Contemporary Japan. Stanford University Press, Palo Alto (1974)
4. Shimane, K.: The experience of death in Japan's urban societies. Invisible Population: The Place of the Dead in East-Asian Megacities, pp. 29–49 (2013)
5. Wolf, A. (ed.) Religion and Ritual in Chinese Society (Study in Chinese Society). Stanford University Press (1974)
6. Lazzarotti, M.: Modern life traditional death. Tradition and modernization of funeral rites in Taiwan. Fu Jen Int. Religious Stud. **8**(1), 108–126 (2014)
7. Kim, J.: Necrosociality: isolated death and unclaimed cremains in Japan. J. R. Anthropol. Inst. **22**(4), 843–863 (2016)
8. Tremlett, P.F.: Death-scapes in Taipei and Manila: a postmodern necrography. Taiwan Comp. Perspect. **1**, 23–36 (2007)
9. 内政部全國殯葬資訊入口網. https://mort.moi.gov.tw/
10. Kaohsiung City Government: Mortuary services office Kaohsiung City (高雄市殯葬管理處). https://mentality.kcg.gov.tw/
11. 中天快點 TV: 雲端追思系統 掃墓祭拜聽線上遺言 (2017). http://gotv.ctitv.com.tw/2017/03/416535.htm
12. Uriu, D., Odom, W., Gould, H.: Understanding automatic conveyor-belt columbaria: emerging sites of interactive memorialization in Japan. In: Proceedings of the 2018 Designing Interactive Systems Conference, pp. 747–752 (2018)
13. Kong, L.: No place, new places: death and its rituals in urban Asia. Urban Stud. **49**(2), 415–433 (2011)
14. Duteil-Ogata, F.: Emerging burial spaces and rituals in urban Japan. Invisible Population: The Place of the Dead in East-Asian Megacities, pp. 50–73 (2013)
15. Inoue, H.: Contemporary transformation of Japanese death ceremonies, pp. 123–137 (2013)
16. Suzuki, I.: Beyond ancestor worship: continued relationship with significant others, p. 141 (2013)
17. Gould, H., Kohn, T., Gibbs, M.: Uploading the ancestors: experiments with digital Buddhist altars in contemporary Japan. Death Stud. 1–10 (2018, to be published)
18. Tomoetogyo Co., Ltd. (トモエ陶業株式会社): Mayudama (繭環). http://mayudama.hanatofumi.jp
19. Tomoetogyo Co., Ltd. (トモエ陶業株式会社): TORUS. http://torus.hanatofumi.jp
20. Google: Google photos. https://photos.google.com/
21. Cann, C.K.: Virtual Afterlives: Grieving the Dead in the Twenty-First Century (Material Worlds Series). University Press of Kentucky (2015)
22. Arnold, M., Gibbs, M., Kohn, T., Meese, J., Nansen, B.: Death and Digital Media. Routledge, Abingdon (2017)
23. Facebook: About Memorialized Accounts, Facebook Help Center. https://www.facebook.com/help/1017717331640041/
24. Graham, C., Arnold, M., Kohn, T., Gibbs, M.R.: Gravesites and websites: a comparison of memorialisation. Vis. Stud. **30**(1), 37–53 (2015)
25. Gibbs, M., Meese, J., Arnold, M., Nansen, B., Carter, M.: #funeral and instagram: death, social media, and platform vernacular. Inf. Commun. Soc. **18**(3), 255–268 (2015)
26. Walter, T.: Communication media and the dead: from the stone age to Facebook. Mortality **20**(3), 215–232 (2015)
27. Brubaker, J.R., Callison-Burch, V.: Legacy contact: designing and implementing post-mortem stewardship at Facebook. In: Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems CHI 2016, pp. 2908–2919 (2016)

28. Gotved, S.: Privacy with public access: digital memorials on quick response codes. Inf. Commun. Soc. **18**(3), 269–280 (2015)

29. Bodaiju (菩提樹): Digital *kakocho* (デジタル過去帳). http://dejikako.com/

30. Häkkilä, J., Forsman, M.T., Colley, A.: Navigating the graveyard: designing technology for deathscapes, pp. 199–204 (2018)

31. Okiseki Co., Ltd. (株式会社沖セキ): *Ohaka-Mairu* (お墓マイル). http://www.okiseki.com/app/

32. Massimi, M., Charise, A.: Dying, death, and mortality: towards thanatosensitivity in HCI. In: Proceedings of the 27th International Conference Extended Abstracts on Human Factors in Computing Systems, CHI EA 2009, pp. 2459–2468 (2009)

33. Foong, P.S., Kera, D.: Applying reflective design to digital memorials. In: Proceedings of International Workshop on Social and Mundane Technologies, SIMTech 2008 (2008)

34. Sengers, P., Boehner, K., David, S., Kaye, J.J.: Reflective design. In: Proceedings of the 4th Decennial Conference on Critical Computing, CC 2005, pp. 49–58 (2005)

35. Uriu, D., Ogasawara, T., Shimizu, N., Okude, N.: MASTABA: the household shrine in the future archived digital pictures. In: ACM SIGGRAPH 2006 Sketches (2006)

36. Uriu, D., Okude, N.: ThanatoFenestra: photographic family altar supporting a ritual to pray for the deceased. In: Proceedings of DIS 2010, pp. 422–425 (2010)

37. Uriu, D., Odom, W.: Designing for domestic memorialization and remembrance: a field study of fenestra in Japan. In: Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems, CHI 2016, pp. 5945–5957 (2016)

38. Uriu, D., Odom, W., Lai, M.K., Taoka, S., Inami, M.: SenseCenser: an interactive device for sensing incense smoke & supporting memorialization rituals in Japan. In: Proceedings of the 2018 ACM Conference Companion Publication on Designing Interactive Systems, pp. 315–318 (2018)

39. Wallace, J., Thomas, J., Anderson, D., Olivier, P.: Mortality as framed by ongoingness in digital design. Des. Issues **34**(1), 95–107 (2018)

40. Moncur, W., Kirk, D.: An emergent framework for digital memorials. In: Proceedings of the 2014 Conference on Designing Interactive Systems, DIS 2014, pp. 965–965 (2014)

41. Wendy, M., Julius, M., van den Hoven, E., Kirk, D.: Story shell: the participatory design of a bespoke digital memorial, pp. 470–477 (2015)

42. Odom, W., Uriu, D., Kirk, D., Banks, R., Wakkary, R.: Experiences in designing technologies for honoring deceased loved ones. Des. Issues **34**(1), 54–66 (2018)

43. Odom, W., Banks, R., Kirk, D., Harper, R., Lindley, S., Sellen, A.: Technology heirlooms?: considerations for passing down and inheriting digital materials. In: Proceedings of the 2012 ACM Annual Conference on Human Factors in Computing Systems, CHI 2012, pp. 337–337 (2012)

44. Pitsillides, S.: Digital legacy: designing with things. Death Stud. (2019, to be published)

45. ChinPaoSan Group (金寶山集團). https://www.memory.com.tw/en/

46. Wang, Y.L., Liu, E.: Seven Days in Heaven (父後七日) (2010)

47. Bellco (ベルコ): お葬式の流れ: (procedure of funeral). https://www.bellco.co.jp/sougi/flow/

48. Wiren, A.: Japanese Funerals, Japan Visitor. https://www.japanvisitor.com/japanese-culture/japanese-funerals

49. Dexter, K.: The many Japanese calendars and the ways Japan tells time (2014). https://www.tofugu.com/Japan/Japanese-calendar/

50. Takita, Y.: Departures (in English)/おくりびと Okuribito (in Japanese) (2008). https://en.wikipedia.org/wiki/Departures_(2008_film)

51. Asukanet Co., Ltd. (株式会社アスカネット): Memorial service division. https://www.mds.ne.jp/

52. Tsai, M.C.: A study on online memorial services and model construction. Master thesis at Department of Life and Death, Nanhua University (2010)

53. NCTU CastNet: 線上祭祀 科技與文化衝突 (2018). http://castnet.nctu.edu.tw/castnet/article/1594

54. Asukanet Co., Ltd. (株式会社アスカネット): *Iei* bank (遺影バンク). https://ieibank.com/

55. Nokosu Kioku.com (のこす記憶.com): What is Shu-katsu? https://nokosukioku.com/note/?page_id=818