Chapter

13

Technological and Human Challenges to Addressing Death in Information Systems

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Abstract

The area of Information Systems is being challenged by new cultural and technological scenarios to address the phenomenon of death in the light of technical, cultural, legal, ethical and affective principles. Besides, there is an urgent demand for project solutions to digital legacy bequeathed by deceased users.

13.1. Introduction

Death is part of life; therefore, it should be properly addressed in computational environments. As technology develops, information systems that used to store data in a desktop computer (with a single user logged in) have undergone drastic changes. Nowadays the number of multiuser and distributed systems are growing with the result that data are stored at different locations and in different manners to be accessed individually or collectively. However, what happens to the data when their owner dies?

As we know, humans are essentially social creatures. Therefore, their presence in web environments and the complexity of modeling systems that represent human relations in the real world are challenging tasks [MACIEL 2011]. These involve addressing their post-mortem digital legacy, a promising new area in which Brazilian researchers have made major contributions. The end of life is an interesting research domain for many reasons – multidisciplinary, social and cultural ones –, especially due to the technological challenges to addressing this issue.

When it comes to the fate of someone's digital legacy, control mechanisms may be created so the user can: a) name a person who will be responsible for the contents in that system; b) opt for the immortality of his/her digital life; or c) program the account to be deleted if a definite set of actions are no longer performed. However, modeling such mechanisms, especially within the social web and all its social network applications, is a complex task, which must be carried out considering users' needs (functional requirements) and the characteristics of the product (nonfunctional requirements). Despite these challenges, the great number of

social applications on the web entails the creation of digital spaces where cultural practices regarding death are performed. See for instance, digital memorials, i.e. web environments that allow users to pay homage to the dead [LOPES, MACIEL, PEREIRA 2014].

Considering different goals for the creation of Digital Heritage Management Platforms (DHMP), based on literature review and on an analysis of related systems, Oliveira *et al*. (2016) propose four sets of functionalities: a) messages – functionalities to send previously configured messages; b) memorial – functionalities to create online memorials; c) management of digital heritage; and d) digital immortality – functionalities to create a bot/avatar that simulates the user's behavior. According to the authors, those functionalities are aimed at creating a cloud-computing platform.

Given this background, issues related to users' death are presented here as challenges to the development of information systems. The great challenge for the Information Systems community is to investigate how to address death and design solutions for digital legacy systems in light of technical, cultural, legal, ethical and affective principles. This article is based on a literature review, on previous studies we have conducted [MACIEL 2011], [MACIEL; PEREIRA 2013], [MACIEL; PEREIRA 2015], and on the analysis of websites and social web systems.

13. The theme in different communities

In 2009, for the Brazilian Internet Steering Committee (CGI.br) to base and guide its decisions according to fundamental propositions, ten principles for the use of Internet in Brazil (CGI.Br 2009) were established. Among others, these principles include freedom; privacy and human rights; innovation; functionality; security and stability; and a legal and regulatory environment. These principles meet the goals of this article, and results from research in this area can help address death within the realm of information systems.

The Brazilian Computer Society established the Grand Research Challenges in Brazil from 2006 to 2016 [MEDEIROS 2008]. Among the five research challenges, four are related to the issue discussed here: Management of information over massive volumes of distributed multimedia data; computational modeling of complex systems: artificial, natural, socio-cultural, and human-nature interactions; participative and universal access to knowledge for the Brazilian citizen and Technological development of quality: dependable, scalable and ubiquitous systems.

In 2012, the Human-Computer Interaction Special Committee (CEIHC), from the Brazilian Computer Society (SBC), launched a call for "GranDIHC-BR: Grand Research Challenges for Human-Computer Interaction in Brazil", within IHC'12. At the time, researchers from the area identified great challenges, detailed in [BARANAUSKAS, de SOUZA, PEREIRA 2014]. Among these challenges, the ones related to human values stand out: privacy in the connected world and posthumous interaction and post-mortem digital legacy. In turn, these aspects entail a subsequent challenge: professional development for HCI and the market because systems related to post-mortem issues have been developed by companies that discovered this novel and promising market niche. From then on, there has been growing interest in themes related to death and digital legacy and research within the HCI community has been fostered.

At the international level, the association between technology and death has attracted the attention of the academic community too, resulting in conferences, papers and books. For instance, members of the Brazilian community organized the book *Digital Legacy and Interaction: Post-Mortem Issues* [MACIEL, PEREIRA 2013] in 2013, at the invitation of Springer. This invitation was made considering the impact of the first papers by the authors [MACIEL 2011], [MACIEL, PEREIRA 2012], [MACIEL, PEREIRA 2013) about death and HCI. The book is an international and interdisciplinary work as it contains chapters by researchers from different countries and fields, such as Computer Science, Design, Languages, Arts and Law. In 2015 a paper

presenting the challenges posed by death and mortality to human-computer interaction was presented to the international community [MACIEL, PEREIRA, 2015]. These studies, as well as others from related issues should be shared among different communities, especially the Information Systems one, where such discussions are still incipient.

14. Some studies in the area

Before we discuss some studies in the area and the challenges researchers have been faced with, it is important to understand the main concepts related to death, mortality and legacy regarding technology. Carroll and Romano (2010) define that "a digital legacy is a summation of the digital assets you leave behind to others. As the shift to digital continues, the digital legacy left behind will become a greater part of your overall legacy".

In turn, there is the definition of digital assets by Oliveira *et al*. (2016) (*apud* Carrol and Romano, 2010). For them, digital assets are all the e-mails, files in digital formats, images, audio, videos or similar digital files which are stored in digital devices, desktops, laptops, tablets, peripherals, storage devices, telephones, cellphones, smartphones or any similar digital device available now or in the future, irrespective of their physical properties. In turn, digital accounts are email accounts, software licenses, social network and social media accounts, financial management accounts, domain names, web hosting accounts, online stores, affiliate programs and any other existing or future digital accounts.

Bellamy *et al*. (2014) use the term "digital property" to refer to all digital assets. For Brubaker *et al*. (2014), digital heritage consists in the full set of digital properties a user leaves behind to an heir. According to the authors, digital legacy can represent identity, social interaction, intellectual property and other activities that might identify the user. The challenge posed by this heritage, according to each country's legal system, is to define who the heirs are.

In a research carried out in Portugal, de Oliveira *et al*. (2016) discovered that most interviewees do not think about the fate of their digital heritage, and do not even know the policies imposed by the online services they use. Their research also shows that, the more technologically mature users are, the more likely they are to become users of digital heritage management platforms.

Massimi and Charise (2009) have coined the term *thanatosensitivity* to describe an approach that actively seeks to integrate the facts of mortality, dying, and death into design and research in the area of Human-Computer Interaction. The group led by these scholars has carried out many studies in the area, both through workshops and scientific research. In 2011, Massimi *et al*. (2011) argued that research in HCI should address death in a lifespan-oriented approach. According to them, there are four main groups of stakeholders in this area: the living, the dead, the dying and the bereaved; besides, there are four main thematic areas that map out what research on the end of life might include: materiality, identity, temporality and research ethics/methods.

In 2011, Maciel carried out a preliminary study in Brazil with software engineers to investigate the possibilities for users to previously configure their post-mortem intentions within the system. The answers collected from the developers encompassed the following solutions for the fate of digital legacy: a) attributing password power to third parties, while alive or in a will, attesting the wish for posthumous interaction; b) having a registration number of the digital legacy in the equipment or in the network, so that a login is not necessary for access; c) keeping a link with real world institutions and documents to confirm a passing away in the Social Web context; and d) providing resources in the Social Web applications to register users' volition. The latter entails software programs providing settings for users to determine what their wishes are towards the fate of their digital legacy. That means users would have decision power on their

legacy after this inescapable phenomenon: death. All the aforementioned solutions permit us to investigate the needs of users and applications from the developers' perspective, permeated by beliefs and taboos, so as to foster this discussion within the Information Systems community.

For Maciel and Pereira (2012), the idea that people may record their post-mortem desires in software is also to ponder the way taboos on death have been recodified in different societies in modern times, especially after the Internet. Here recodifying means rethinking, changing symbolisms and facing one's own mortality. As a philosophical activity, this kind of research involves understanding modern human taboos towards death and digital legacy on the Internet. Thus, the authors ask: to what extent are software engineers influenced by their own taboos and beliefs on death when they have to think of solutions for user digital legacy by means of software settings? This question arose from the aforementioned research [MACIEL 2011], especially regarding how users express their volition through software.

From the answers research participants gave to the survey, it is clear that their discourse was permeated by taboos and beliefs regarding death, which influenced the digital legacy solutions they could propose. Given the need to understand how those cultural aspects could influence the design of *thanatosensitive* solutions [MASSIMI, BAECKER 2010], the implicit and explicit taboos and beliefs identified in the respondents' answers were put into seven groups. Table 13.1 shows these groups, the number of respondents who expressed these ideas in their answers and the corresponding percentage among the 83 interviewees.

Categories	**Respondents**	**%**
Non-profanable legacy	14	16.86
Funeral rites	13	15.66
The immaterial beyond death	27	32.53
Death as an end	30	36.14
Death as adversity	12	14.45
Death as an interdiction	8	9.63
The space required by death	7	8.43

Table 13.1. Categories of taboos and beliefs regarding death

The analysis of the software developers' answers suggests that their expectations for post-mortem digital legacy are permeated by beliefs, and moral, religious and ideological values, which can influence the design of *thanatosensitive* solutions. These cultural values must be further studied to support the development of information systems in the area.

It is also necessary to study what is more tangible in post-mortem digital legacy: posthumous interaction [MACIEL, PEREIRA 2012], which can be represented by online mourning (for instance, by creating specific groups for a deceased person, visiting dead users' profiles, or changing one's photos in a web profile, so as to add an image that conveys the user's grief). The concept of posthumous interaction refers to the interaction between systems and the dead users' data, or between living users and deceased ones via the system. For the authors, it is a surprise that, among the research subjects, 59% had already interacted in their social networks with dead users' profiles. Although this issue is more directly related to the area of Human-Computer Interaction, the Information Systems community should also have this discussion, owing to the need to design systems that are sensitive to posthumous interaction.

Researchers have been working on different fields concerning digital legacy and posthumous interaction. These studies address technical, legal, cultural and affective aspects of the relationship between death and technology. In the market, some systems and functionalities have been created to meet this growing demand, and this has fostered new academic studies in this area.

In Brazil, Google launched *Google Inactive Accounts*, which enables users to manage data in their accounts [MACIEL, PEREIRA 2013], [PRATES, ROSSON, de SOUZA 2015], (BAHRI, CARMINATI, FERRARI 2015] and to write a digital will, so as to define the fate of their digital legacy. From the perspective of the Brazilian law, the solutions the market has proposed so far must be improved [MACIEL, PEREIRA, SZTERN 2015], as they have technical and cultural limits and are not aligned with the national legal system. The latter study involved an interpretative analysis of Brazilian law so as to ground the discussion of surveys answered by software engineers about Google Inactive Accounts. Issues such as inheritance rights, the right to be forgotten, temporality of contact information and technical limits of the tool came up in the respondents' answers.

Bertasso (2015) has recently investigated Brazilian law regarding the inheritance of digital assets stored in cloud computing services. The results show that, despite the great number of deceased users, the estimated economic value those assets have and the significant number of people who access cloud-stored services, Brazilian law does not have an objective approach to the right to digital heritage. The author analyzed the terms of use for the cloud storage services of Dropbox[1], Mediafire[2], JustCloud[3], Syncplicity[4] and Wuala[5], focusing on: files and permissions; sharing files; responsibility; copyright; changes in terms of use. The author concluded that the terms of use of all these systems have clauses that exempt them from any legal responsibilities. Besides, they do not cover all situations that may arise in the context of data storage, such as access to a deceased user's data or naming a digital heir.

Developing the aforementioned research, Meireles and Batalha (2016) discuss solutions for the proper handling of a user's digital legacy. To do so, they present prototypes of pieces of software whose main functionalities are identified in the following tools: Morte Digital[6], Se Eu Morrer Primeiro[7], Safe and Beyond[8], Password Box (Legacy Locker)[9], Addio[10], and Google Inactive Account Manager[11]. Based on an analysis of these tools, the authors sum up the main difficulties they faced in the design of such systems:

[1] https://www.dropbox.com/privacy#terms (Accessed in July 2017)

[2] https://www.mediafire.com/policies/terms_of_service.php (Accessed in July 2017)

[3] http://www.justcloud.com/terms#terms (Accessed in July 2017)

[4] https://www.syncplicity.com/legal/terms-of-service/ (Accessed in July 2017)

[5] https://www.wuala.com/en/about/terms (Accessed in July 2017)

[6] http://www.mortedigital.com.br/ (Accessed in May 2017)

[7] http://seeumorrerprimeiro.com.br/planos (Accessed in May 2017)

[8] https://www.safebeyond.com/ (Accessed in May 2017)

[9] Legacy Locker. http://legacylocker.com/ (Accessed in May 2017)

[10] http://www.addio.com.br/(Accessed in May 2017)

[11] https://www.google.com/settings/account/inactive (Accessed in May 2016)

- taboos about death;
- detecting the death of a user;
- determining who the heirs are;
- data security;
- sharing different sorts of file;
- determining an heir's different kinds of access;
- transfer of passwords;
- storage of posthumous messages.

Considering such difficulties and the functionalities that were identified as necessary to address digital legacy, the prototype of the system "Meu Legado" was built. The authors carried out a usability evaluation of the prototype according to Nielsen's heuristics. They concluded that the system "Meu Legado" presents valid solutions to the problems posed by digital legacy and therefore can be used to help make users aware of the importance of planning the fate of one's digital assets after death.

From a similar perspective, Oliveira *et al*. (2016) discuss the need to create Digital Heritage Management Platforms (DHMP), which are information services based on the SaaS (*Software as a Service*) architecture. The main functions of a DHMP are storing information or data related to digital legacy and allowing users to manage the data, which, in most cases, involves planning what will happen when the user dies. Such services instruct the user on how to gather and organize their digital legacy. Users are instructed on how to store information and organize detailed plans for what they would like to happen to their legacy. These plans allow the user to decide on what information from the account can be shared, and who with; or how they want to get rid of any legacy.

For the authors, the main goals of these platforms are:

- Storing digital legacy
- Managing digital legacy (gathering, planning)
- Preventing information loss
- Preventing identity theft
- Supporting online accounts management
- Creating online memorials
- Storing information to build a bot or an avatar of the user
- Helping in the grief process

By means of a preliminary analysis of these platforms, Oliveira *et al*. (2016) identified some standard functionalities, described below in stages:

1. The user creates an account, inserts an inventory of his or her digital heritage and saves his or her data and information;
2. The DHMP delivers a unique code;
3. The user defines a digital executor and delivers the unique code to him or her;
4. The digital executor informs the app about the user's death;
5. The DHMP app tries to communicate with the user within the previously set deadline;
6. Should that communication attempt not be successful, the DHMP triggers the actions previously defined by the user.

For Bahri, Carminati and Ferrari (2015), because privacy preferences vary widely among users according to their cultural and personal values, digital legacy planning must be considered as highly dependent on circumstances to be effective. There are many types of data, and their value is entirely subjective for each user.

That makes it more complex to develop digital legacy solutions, because in a single application, different kinds of data might be destined to different heirs. Take, for instance, the Google platform, where a single password gives access to emails (Gmail), photos (Google Photos), social network (Google Plus), among others.

In a collaborative workshop with elderly people, Thomas and Briggs (2014) studied the participants' values regarding digital heritage. By adopting the *Value Sensitive Design approach*, the researchers realized that there was a clear difference in the value systems when they were applied within or without the scope of the family. Participants emphasized the importance of digital legacy within the scope of the family, so that new generations could know some of the history of their ancestors and family bonds were strengthened. However, most respondents did not feel comfortable with the idea of sharing information about deceased relatives with strangers. In turn, as to beyond the scope of family, participants said that information about legacy could benefit people in a wide range of contexts, but less emotionally.

Related to this, Brubaker *et al*. (2014) point out that many different kinds of data are generated in social networks, and they recommend a framework of solutions to manage them. This framework is divided into two stages: support and assistance for users to plan their digital legacy; and carry out the plan after the death is confirmed. In the first stage, users categorize their data into "for donation", "digital legacy", "intellectual property" or "destructible data". Next, the user must choose to whom (and with what privilege level) each category of data is to be bequeathed. In the second stage of the framework, the user's plan for his or her digital legacy must be carried out as soon as his or her death is confirmed. The first measure to be taken is the deletion of destructible data.

The authors believe there are two main challenges in the second step: a) the time for execution, that is, the system must have a mechanism to identify whether the user is dead (which can be done based on an inactivity period or on a warning from a third party) and only then carry out the plan for his or her digital legacy; and b) handling data in secrecy, so as to respect the wishes previously defined by the user before death. Brubaker *et al*. (2014) also highlight that handling digital legacy is a great challenge in case of the passing away of whole families or communities, such as in natural disasters.

Another systemic perspective is the development or transformation of digital profiles into digital or online memorials. The concept of a digital memorial is derived from the concept of memorials in the physical world, where concrete monuments are made to symbolize and honor the memory of a person or an event. According to Riechers (2013), all personal memorials come from a common human need: honoring death in a context that evokes memories of pain and happiness, and comforting the bereaved. In digital memorials, those practices are transferred to the web, thus allowing users to pay homage to dead people through virtual candles and flowers, or even through verbal messages. Some systems include also options to "pray" for the deceased. For Carrol and Romano (2010), online memorials are particularly unique because they transcend space and time. For example, one can attend a virtual memorial or visit a tomb or any other memorial through the web anywhere, at any time.

In a study about digital memorials, Lopes, Maciel and Pereira (2014|) analyzed the

systems iHeaven[12] and Saudade Eterna[13], which are no longer online. Based on the inspection of these platforms and on a qualitative analysis in the light of social network features, together with results from tests with uses, the authors created some practical recommendations for the design of digital memorial software. These recommendations and the related prototypes provide guidelines that designers of solutions for this area should follow so as to meet users' expectations upon navigating that kind of social software, preserve deceased users' reputation and the respect for them, and safeguard multiculturalism in these applications.

Another system in this area is *Digital Memorial*[14]. According to its website, "*Digital Memorial create and implement digital memorial solutions to improve family and friends usage and experience in memorializing a 'loved one'. We are a memorialization technology company located in the UK but working throughout Europe, North America, South East Asia… Digital Memorial is committed to giving excellent customer service*". *Digital Memorial* services include QR code products and solutions; NFC (*Near Field Communication*) software and tags; the campaign "Keep their memory alive"; GPS solutions; sites and gift boxes to show sympathy. The great market behind this solution is therefore clear.

Facebook has the option to change a common profile into a digital memorial after a form is filled in, proving the user's death. According to Facebook[15], "*Memorialized accounts are a place for friends and family to gather and share memories after a person has passed away. Memorializing an account also helps keep it secure by preventing anyone from logging into it. If Facebook is made aware that a person has passed away, it's our policy to memorialize the account*". Below (Figure 13.1) we can see the interface with the memorialization request form[16].

Also in Facebook, it is possible to determine an heir contact for your account. This option is available in the security settings of the user's account. According to Facebook,[17] "*A legacy contact is someone you choose to look after your account if it's memorialized. Once your account is memorialized, your legacy contact will have the option to do things like:*

- *Write a pinned post for your profile (ex: to share a final message on your behalf or provide information about a memorial service)*
- *Respond to new friend requests (ex: old friends or family members who weren't yet on Facebook)*
- *Update your profile picture and cover photo*".

[12] http://www.iheaven.me/ (Accessed in May 2014)

[13] http://www.saudadeeterna.com.br/ (Accessed in May 2014)

[14] http://www.digital-memorial.com/ (Accessed in October 2016)

[15] https://www.facebook.com/help/150486848354038?helpref=faq_content (Accessed in October 2016)

[16] Form accessed in October 2016.

[17] https://www.facebook.com/help/1568013990080948?helpref=search&sr=21&query=memorial Accessed in October 2016.

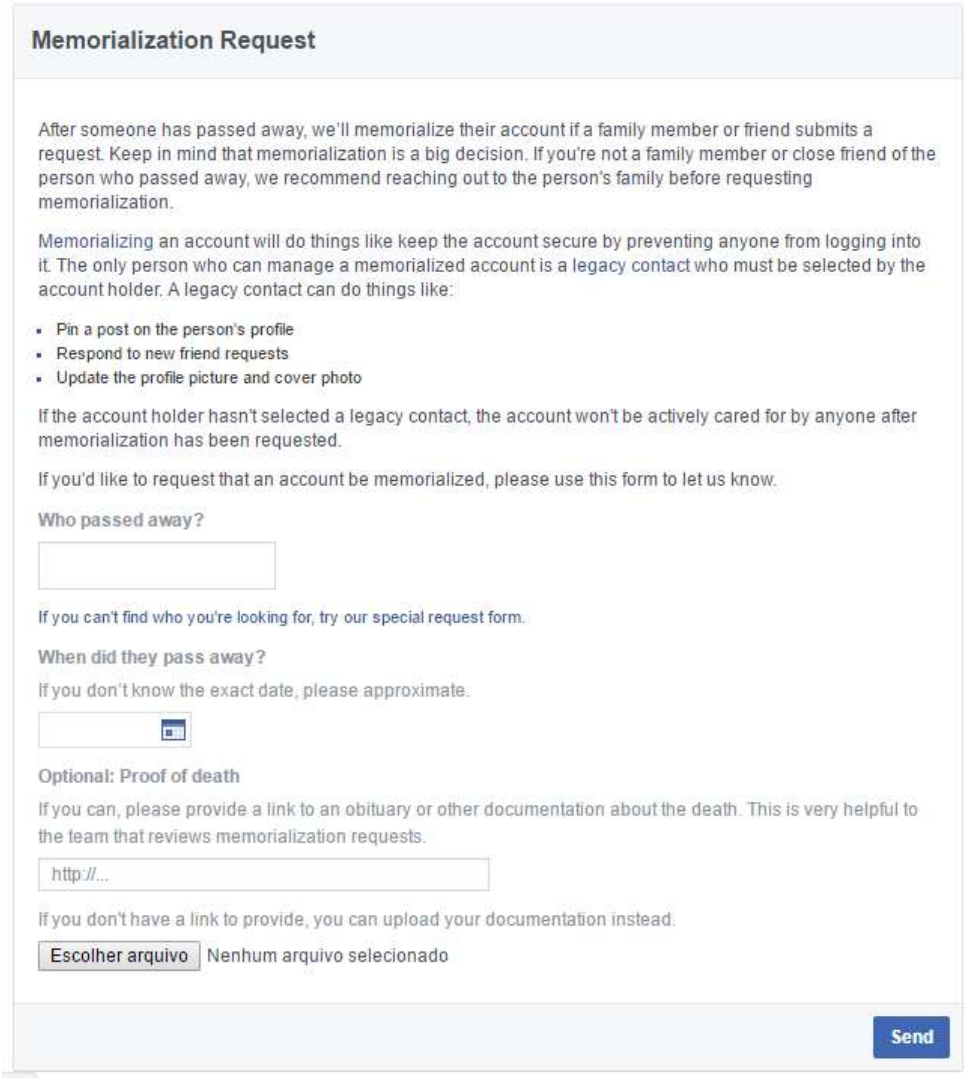

Figure 13.1. Request to change a profile into a memorial in Facebook

The system allows the heir contact to download a copy of everything that was shared in Facebook. In this help page, there is also the message: "*You also have the option to allow your legacy contact to download a copy of what you've shared on Facebook, and we may add additional capabilities for legacy contacts in the future".* This strengthens the ideas in this challenge, as other options can be considered for deceased users' profiles in social networks such as Facebook.

Pereira, Maciel and Leitão (2016) have carried out semiotic studies of design elements in real-world artifacts such as tombs, tombstones and physical memorials. Their analysis considered cultural elements from different societies and was based on a previously selected sample. By investigating the real-world domain, the authors elicited design requirements and built theoretical and speculative knowledge in the domain. Their main contributions are: a) a description of the design space of digital memorials, in terms of the actors involved and their objectives upon interacting with the application; and b) scaffolds to reflect upon the design process of digital memorials.

Bahri, Carminati and Ferrari (2015) warn that: a) in Facebook, a memorial can be seen by friends according to the privacy preferences of the deceased user's account, which were determined by the user before his or her death; b) a memorial cannot be found by unknown

people through searches; and c) it is not possible to add a deceased user's profile as a friend. The authors also highlight that, as there are interactions in social networks that persist longer than a user's lifetime, it is necessary to design a system with a platform for social activities among circles and groups previously established by the deceased user. In this case, the authors suggest that the heirs act as stewards or mediators, who execute the deceased user's wishes although they do not have access to his or her accounts or data. That would enable the management of sensitive data, such as material that might damage the deceased user's image or be considered as SPAM.

Another functionality that has been offered to users is the possibility of sending posthumous messages. Pereira *et al*. (2016) analyzed the future impact of settings in the domain of posthumous communication. The authors called posthumous communication the process of sending, after a user's death, a message previously written by him or her. Their analysis explores two different perspectives. The first one is related to how designers help users understand the future impacts of settings they choose. According to Prates *et al*. (2015), there is a challenge in the design of system settings when the effects of those settings are not in the short term, demanding an anticipation of interaction. The second perspective has to do with recommendations for designers to define requirements related to volitional aspects in the context of digital legacy (MACIEL, 2011). The authors' goal was to come up with indicators for what each perspective can inform about posthumous communication, and what the gains are from combining them. To do so, the authors analyzed two tools that send posthumous messages to family and friends: "*If I Die*"[18] and "*Se Eu Morrer Primeiro*"[19]. Each system was analyzed through the Semiotic Inspection Method (SIM) [de Souza *et al*. 2006] and then from the perspectives of settings with future impacts [PRATES et al. 2015] and volitional elements regarding post-mortem digital legacy [MACIEL 2011]. As results, the authors present a thorough analysis of these two tools and the specific functionalities designers provide users with. Furthermore, there is a discussion about the particularities of systems that focus on posthumous communication, so they broaden the discussion on concepts related to the management of posthumous messages.

Among their research findings, Pereira *et al*. (2016) discuss how posthumous communication systems permit the sending of messages with various contents. For example, instructions on how to proceed after the user's death, instructions on access to some physical or digital asset left behind by the deceased user, or even sentimental messages. Therefore, users must understand not only what messages they can send, but also the implications of the decisions they make and express in the system settings regarding the sending of the messages (what will trigger the sending, who will receive them etc.). To do so, the designers must allow the user to anticipate the interactions that will be made available in the system, and what is more, they must make it very clear how that must be done.

Another example of a system for posthumous communication is Perpetum[20], an application that provides the user with a number of choices of actions he or she may want to be performed after death. For example, the user may choose to have a post in his Facebook

[18] https://ifidie.org/. (Accessed: September 2016).

[19] http://www.seeumorrerprimeiro.com.br/ (Accessed: September 2016).

[20] https://perpetu.co/ (Accessed: October 2016)

timeline informing all his or her friends about his or her death or the automatic forwarding of emails from the dead user's account to someone else etc.

The aforementioned studies show that research in the area has addressed death in information systems in different and interdisciplinary ways. Many companies have also been producing systems related to death, mortality and heritage; those solutions must be critically analyzed through research approaches.

15. Challenge Proposal

Given what we have seen, the great challenge to the Information Systems community is to investigate how to address death and design solutions for digital legacy systems in the light of technical, cultural, legal, ethical and affective principles.

The study of those issues will enable us to draw up guidelines to conceive systems that consider the fate of digital legacy embedded in software and to inform normative institutions on the discussion of those issues, from an interdisciplinary perspective. Further investigation is required into how web systems, such as cloud computing applications, social networks and digital memorials, have been used and developed when it comes to death-related phenomena.

The design of solutions has been addressed in different ways in the area of Information Systems, some of which have been briefly presented in this chapter. As many of these elements are modeled in sets of systems, the development complexity is enhanced. For example, it is possible to tag different people (identities) in a photo and share it in different places, allowing varied social interactions. However, if this photo is deleted, how should we handle the persistence of data should a deceased user want that photo to be erased from his or her account in a social network?

With the popularization of digital assets and digital contents produced by users, the management of such data gets increasingly complex. Therefore, handling it as future legacy becomes a challenge. First of all, it is usually scattered in multiple spaces: there are not only data available online, but also stored in personal computers and mobile devices, for instance. Besides, data (such as documents and photos) must be classified into inheritable or non-inheritable items by the user. However, each user stores and organizes different sorts and amounts of information, thus adopting distinct classification patterns. As that (dis)organization of data threatens memory preservation, digital content curatorship is a growing concern for archivists. If it is hard to identify what is valuable in a great mass of digital contents, there is a risk something important may get lost. Besides, if data are locked in password protected accounts, they cannot be accessed anymore. On one hand there is the concern with memory preservation; on the other, there are the ethical aspects of accessing data, such as users' privacy or even the reuse of data to recreate life through artificial intelligence. Therefore, it is fundamental to make users, software engineers and analysts aware of these ethical aspects.

Among the challenging research questions for this area, we can highlight the following:

- handling bereavement in systems where posthumous interaction takes place, considering the users' emotional workload
- discussing, from the perspective of each country's legal system, to what extent companies should be exempt from legal responsibilities regarding the user's digital legacy, which has consequences for the terms of use
- the systemic complexity regarding the diversity of data and their use, as well as the variety of technological devices and storage resources, such as clouds

- respecting users' privacy, which heavily depends on the way data are forwarded to the heirs
- constantly debating this theme, so as to overcome taboos on death that might influence the design of solutions
- carefully detecting death, handling heritage, and making sure the heir meets his/her responsibilities properly.
- managing the conflict caused by settings in different systems, or even by the different decisions configured in the systems and in a formal will in the physical world
- defining the limits and possibilities for posthumous communication systems
- defining the limits and possibilities for immortality within software programs, considering artificial intelligence tools

From a methodological point of view, we have the following challenges:

- interdisciplinary research, as designing sociotechnical systems demands a multicultural and multiperspective understanding of different epistemological fields
- the bond between academy and market, so as to develop solutions that properly address the impact of death and digital legacy on users and society as a whole
- the use of varied techniques, methods, procedures and tools in system analysis. Techniques from the Information Systems area, such as Business Process Modeling, can be especially useful in that context
- the analysis of objects and phenomena in the real world, so as to bring elements to system projects in digital environments
- studying the profile of each user generation, as they may have different actions and reactions towards these systemic possibilities
- studying new computational solutions as well as the existing ones.

The advances in this challenge can be assessed based on the amount of research carried out in different communities, on the quantity of projects in the area, and on the advances in terms of functionalities implemented in existing information systems and in new ones.

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