Using Social Media to Express Grief While Considering Security Vulnerabilities of Inactive Accounts of the Deceased

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Abstract. It is through social media profiles that we can express loss, find support, and create online memorials of those who have died. Online profiles can be a powerful medium to both create a digital memorial and to also "communicate" with the dead. It is the communication with the deceased that is important to consider as we strive to understand how these tools can be used in the context of bereavement. At the same time, there are many security issues related to data and personal information of the deceased. The various profiles and user data we leave behind after our death can be a cause for concern from a security perspective. Complicating this issue is not knowing where data is located or account details and not having accounts secured. It is also problematic when it is not known when an account belongs to a deceased user, opening the door for exploitation. This project follows previous research on our efforts to automatically identify accounts through SADD - A Social Media Agent for the Detection of the Deceased. This project focuses on digital legacy issues from a security perspective and implications to consider for various digital platforms. In addition, we examine how social media can be used to express grief and continue bonds with the deceased.

Keywords: Digital legacy security · Thanatechnology · SADD · Profiles · Social networks · Grief

1 Introduction

Most online activities leave "digital footprints" behind or require creating and maintaining some form of user profile where various types of information is stored. As an increasing number of users interact with and use social media platforms, cloud services, streaming media, online financial accounts and more, the number of separate accounts

each person has continues to grow. Many people have several password-protected accounts. Some of these accounts may not be known to friends or family members. Social media data, including postings and profile interactions, contribute to our profile and timeline which chronicles the many activities of our daily lives. We leave a trail of data and information in our everyday interactions with technology. Sometimes this "trail" becomes part of our digital legacy, often unintentionally.

Social media has also influenced how we grieve as individuals are increasingly expressing themselves online. As a Web 2.0 technology, social media allows for dynamic interaction with other people where users can post many types of information, such as text, video, images, and more [1]. These pieces of information can also be thought of as "narrative bits" that describe and represent a person and their interactions over time, essentially building a digital narrative [2]. A great deal of personal information is posted in online profiles each day describing our lives representing who we are while serving as a communication tool. However, what happens to this online narrative when we die? How does this affect those we are connected with online? An increasing amount of people are living out parts of their lives through online social media, and as an extension, these platforms are becoming vehicles for expressing grief and for memorialization of the dead [3].

It is through these profiles that we can express loss, find support, and create online memorials of those who have died. Online memorial sites and profiles can take many forms and include an array of features and content. Some of this content may be originally posted by the now deceased when they were using the account, while other content may have been posted by the bereaved after the person had died. Online profiles can be powerful a medium to both create a digital memorial and to also "communicate" with the dead. It is the communication with the deceased that is important to consider as we strive to understand how these tools can be used in the context of bereavement. This paper, therefore, examines how social media can be used to express grief and continue bonds with the deceased. Following, a discussion of how social media accounts of deceased users can create security concerns.

2   Using Social Media to Express Grief

As social networking sites have become more integrated into our lives, it has become an important technology that we use to communicate and express ourselves. Many forms of social media allow users to create profiles and interact with others such as Facebook, Twitter, Instagram, Snapchat, and many more. Each platform has different features, and some are more popular within specific age groups. These profiles and connections to others represent aspects of our lives, and at the same time, end up representing us in death allowing other users to stay connected. This connection to others (those alive and dead) afford new ways to express our grief. "In the coming years, the opportunities available to integrate technology into the grieving process will become more pronounced and nuanced" [4, p. 23]. How then do current models of bereavement fit in with varying emerging technologies and different grieving styles? When examining grief and loss through online social media, research suggests that the dual process model (DPM) of coping with bereavement be considered [5, 6].

With DPM, the management of coping with the loss oscillates between stressors (loss-oriented and restoration-oriented) as the person attempts to reorient his or her self and his or her life without the deceased [7]. In other words, people have both good and bad moments as they adjust with such a life change. DPM combines several aspects of bereavement in its description of coping which fit the polymorphic nature of Web content. Social media offers the ability for the bereaved to interact with digital artifacts in a way that allows for expressions (confronting the loss) and to seek support from others while participating in everyday online activities (attending to life changes). At the same time developing a new but continued bond with the deceased can occur through their online presence. However, [5] notes that sometimes sites like Facebook may present bereaved users interaction with the deceased person's profile unexpectedly when they are in a restoration "phase" which could lead to maladaptation. This occurs when a social media platform is unaware that an account is of a deceased user and may suggest the account as a connection to add as a "friend," promote the account in one's timeline or list "remembrance" photos automatically. Receiving a "friendship request" from someone that you know is deceased can be unsettling [8]. A brief discussion on detecting these accounts to preserve the content will be presented later.

Preserving important content in a digital format has also become a changing practice related to expressing grief through the digitization of pictures and other content [9]. Popular digital content often includes photographs, video, and text. Reminiscing through photographs is a way to interact with memories about the deceased that evokes emotions and can be seen as a ritual activity to help cope with the loss [10]. With digital information, storage of the content will not degrade over time or take up physical space, which is a problem with traditional photographs. These digital "memories" can be shared with others along with comments expressing emotion through social media. The technology not only allows for the sharing of content but affords the bereaved a unique opportunity to express themselves in a variety of ways. Social media allows text-based posting that can be commented on, reposted and shared in a multitude of ways and puts grieving into public view, which is most often expressed privately.

In expressing grief publicly online, categorization of how social media was being used by the bereaved was examined through feedback from 454 survey responses, yielding categories for news dissemination, preservations (memorialization) and community (connections, support, witness to grief) [5]. In terms of news dissemination, it is becoming more commonplace to post information about someone's death online. This sometimes is to serve as a notification to those connected to the person's profile online or to serve as an online obituary containing contact information. In terms of preservation, the deceased's profile becomes a memorial of their life based on content that they have previously posted in life, their friended connections and interactions. Often these profiles were never intended to be turned into a memorial but were inadvertently made so through the interaction of bereaved friends and family members. Facebook, for instance, will memorialize an account if notified (with proof) so that a profile can be preserved. Lastly, a community of grief can be observed within the set of connected "friends." In addition to expressing grief, there are several bereavement support groups available within some social networking sites. Sites like Facebook, "provide users with a return to communal mourning through its affordances of inter-active, user-generated, and co-constructed expression of emotions" [11, p. 25]. Using

technology, our expressions of grief can be viewed by others, used to request support, or sent even sent to the deceased in the form of a message.

3 Continuing Bonds with the Deceased

There is a growing set of literature supporting a continuing bonds theory for the bereaved to engage with memories of the deceased [12]. Social media is full of memories in the form of interactive digital artifacts available any time of the day, as long as the profile is still active or has been memorialized. The asynchronous nature of social media, combined with the distorted sense of time, connection over long distances (including death) and social barriers presents unique ways to stay connected with the deceased [13]. Most often when we post content on another person's profile, the user on the other side is not active on their page at that moment, but we assume they will see the post eventually. Extending this idea to the deceased, we may get a sense that they are still listening. Kasket's [16] research supports the theory that users in this context have the perception that "the dead are listening." Social media may give us a false sense that nothing has changed, mainly if the loss is a friend or family member with whom we seldom had interactions.

Brubaker et al. [13] argue that relationships with the deceased continue through the creation of virtual bonds through online profiles. The technology itself allows a stable connection with the deceased's profile, allowing for continued and unchanged interaction (except for the interaction we would otherwise get back from the person). We are still able to share the mundane interactions of everyday life, accomplishments, news, and gossip. Posting this content on the profile itself would be publicly available to other users in the network. Private messages to the deceased could also be sent as a private instant message. However, if the account was designated with a caretaker, then private messages could potentially be accessed by a living person to whom the message was not intended. Memorialized accounts allow those connected to the deceased to still stay connected, but new connections cannot be created. Within Facebook, this process ensures that the content is preserved and prevents the profiles of deceased users from showing up in search results and friend suggestions within the platform. Posthumous interaction with the deceased through social media is an interesting phenomenon that allows continued bonds long after a loss. Rossetto et al. [5] discuss that social media enables users to continue connections or to reconnect with the dead, possibly leading to more adaptive grief outcomes.

On a more extreme side of continuing bonds, there have been projects such as Eter9, a program driven by artificial intelligence that algorithmically examines a person's posts and interaction to learn the behaviors of a person to serve as a replacement in the event of death or absence. Their website states, "The Counterpart is your Virtual Self that will stay in the system and interact with the world just like you would if you were present" [14, p. 1]. Programs like Eter9 are applications that can control someone's profile and post content, comments and other items as it was the original person. However, interacting with a technology-based doppelganger of the deceased has not been well studied as these technologies are still under development. These applications

will still take many more years to become more realistic and natural but may warrant much more research from the thanatology community.

Related to more traditional social media interaction, there have been studies examining how users interact with profiles of deceased users. Facebook can be used to honor the deceased, allowing one to visit postmortem profiles to share memories and maintain connections [15]. In maintaining these connections, research suggests that users found viewing pictures on a deceased person's profile as being beneficial in the coping process [13, 17]. Pictures can be viewed and commented on over time. In observations from [18], while examining Myspace profiles of deceased individuals, other users often posted comments on the deceased user's page most frequently on the day of their death until about day ten. They also noticed an increase in activity on these pages on anniversaries and holidays. As social media has only been around for the past several years, the long-term interaction with this content and its effect on bereavement are yet unknown. A study of teenage Facebook users noted that it was atypical to de-friend a deceased profile [17]. Doing so would be disconnecting the virtual bond between themselves and the deceased. Instead of de-friending, users adjust their rela-tionship with the deceased redefining their bonds [6]. Keeping the friendship allows the deceased to remain part of a circle of friends and family online, just as they were in life.

Another way to continue bonds with the deceased using social media is through the creation of official memorial pages. These pages are typically built with the purpose of memorializing the deceased instead of using a page that was their actual profile. This has the added benefit of filtering out specific perceived negative photos, comments or other content. A family member or personal friend could be designated to create the memorial after the death or could be created spontaneously as a group page from the user's network of friends. "Memorial websites and web cemeteries are designed to commemorate and remember the deceased, and they provide site users an outlet for emotional expression, reminiscing, disclosure, paying tribute continuing bods, sharing grief, and establishing community following a loss" [5, p. 975]. These are more per-manent sites that would be open to the public, but more in-depth than an online obituary. Just like in a traditional cemetery where someone may leave a note or flowers, in a similar fashion comments can be posted along with images to not only commu-nicate to the deceased, but to other users that may be grieving.

4 Security Concerns

The data contained in profiles, databases, and accounts of the deceased can be of great value. This value can be measured monetarily by a variety of factors or by its senti-mental worth to family, friends and loved ones. Protecting this content can become a source of concern for those engaged in protecting the memory and legacy of the deceased. Therefore, protecting this data and the integrity of the contents is a crucial area of concern. The increase in accounts owned by deceased users will inevitably become a growing security concern. There is value in these accounts in terms of possibilities of what can be done and in terms of the confidential information they contain from a hacker's perspective. If compromised, the inactive accounts of the deceased can be used for malicious purposes. All this data is useful; however, the

question emerges about what happens to it after one's death? There is a growing need for digital asset management in the context of death. Complicating the transference of digital assets is the many legal issues tied to the terms of service agreements and other contracts between users and the company that provides services or storage [19]. In many cases, accounts and content cannot be transferred to other users.

4.1   Identity

Social media platforms that allow for the memorialization of accounts can be useful for families and friends of the deceased in preserving content and memories. These online memorials provide a way to express grief and to preserve content for remembrance. We need to be mindful of these memorials as they open the door to a possible venue for identity theft. A deceased user's profile contains a narrative of the person's life including images and other content that could be used for malicious purposes. How easy would it be to copy the content and create a new profile under a new name? Most likely family and friends of the deceased would be unaware.

Hacked profiles of the deceased are problematic for several reasons. Most obvious is the potential harm caused by upsetting those connected to the deceased that know they are dead. Having the profile suddenly active again, posting content could be very unsettling and harmful to the bereaved. These re-activated accounts could then be used to "connect" with other users (previously not connected) in order to cause harm. Unsuspecting users may visit these compromised pages, and viewing the activity of the page, friended accounts and pictures, may believe the account is of a valid user. Compromised pages could also allow a hacker access to other information, messages and important information that can be used for additional harm. These accounts could easily be used for phishing scams as they were once held by their legitimate owners but are now being used illegally. We also need to be mindful and always on guard for malicious web crawlers that scour online sources for information. These programs may devour large amounts of content while the person is alive without their knowledge. This information can be saved for long periods of time to be used later after the person is deceased and their accounts are not being closely monitored. Therefore, it is important to monitor traffic to protect web content from malicious web crawlers using a variety of techniques [20–22]. The data of the deceased that was thought to be "safe," and protected could be deleted and misappropriated by hackers. Therefore, it is vital to protect these accounts through some form of memorialization or deletion.

As data breaches are becoming common for many types of accounts and involve a wealth of information, the deceased are still susceptible. As companies often notify current users of compromised accounts, the deceased cannot act on these notifications. Family and friends of the deceased most likely will not receive these notifications on their behalf or even realize what accounts the deceased had active before their death. What data then was compromised and what steps could be made to protect this information? It is also possible that the data contained in the breach could impact the living in unknown ways. These accounts are still technically active and compromised, and the deceased user cannot monitor or take corrective security actions to repair the issue. There may be other information that would be useful to hackers such as data stored in the cloud, particularly in accounts that remain active and unmonitored.

Similar to information that can be reconstructed from obtaining data printed on documents through "dumpster diving," discarded electronic devices of the deceased should also be presumed to contain sensitive data. What data could be gained from discarded wearable devices, cell phones, tablets, cameras and more? Family members or those dealing with the person's estate that are managing the items may not realize its importance and discard potentially sensitive items that contain information of concern. Were there passwords for sensitive accounts saved on a spreadsheet that was discarded?

There is a growing importance of considering some type of death management as part of computer services. Particularly useful would be a systematic "dead man's switch" that automatically flags and deactivates all accounts and profiles associated with the deceased. This is a similar approach that some companies are taking to protect user data in the event of a death, such as through Google's Inactive Account Manager [23]. A user can set a period of inactivity before the account is considered inactive and steps are taken to send a message to individual email accounts or phone numbers. A user has a choice to send out messages to up to ten people that the account is no longer in use (based on the time frame selected) as well as the option to delete the account. It is essential to consider if someone should be notified or have access to an essential account in the case of a death. Increasingly as part of a will, this information is being recorded in case of an emergency. Although this too raises many questions, as sharing passwords are generally not allowed as part of most terms of service agreements, can change many times since the account was created, or seen by those in which it was not intended. Additionally, the security of the saved account information must be maintained.

4.2   Transitional Weakness

Our previous work described four states of being related to death as viewed in Fig. 1 [24]. Type A represents users who are physically alive and maintain an active presence in an online platform or environment. Type B represents users who are alive, but who do not have a presence in an online platform. Type C users are those who have physically died but have an "active" virtual memorial or social networking site. This includes the set of users who have died, and someone else created a memorial on their behalf, hence still having an active online presence. Type D users represent those that have died and have no online presence or memorial. The online persona of a type D user could have been erased after their death.

There is a time period where the deceased's data is more vulnerable. This temporal transition period in the states of being can be problematic. Essentially this attack window comprises the time period in which it is not known that the user is deceased, opening several vulnerabilities. For instance, the accounts of the deceased are still active with an expectation that there will still be activity. Therefore, unauthorized access and use of the account might not be detected for some time. This attack window also includes the time when family and friends know that the person is deceased,

but due to their grief may not be actively monitoring certain account information. Although for some, these accounts may be visited much more often during this time. It may take a significant amount of time to identify what accounts and information the now deceased stored online or kept in some digital format.
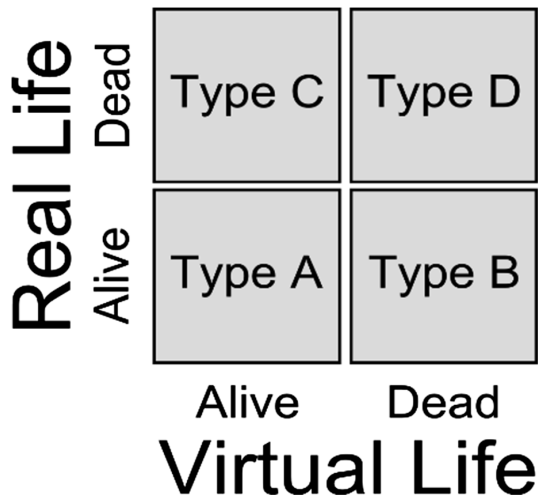

Fig. 1. Four states of Being [24]

Consider the scenario where a distant friend might not know that their friend has died. Perhaps their death was only a day or so ago (or even longer in some cases), and news of the death is not well known. Perhaps the friend lives far away and has limited contact with others that are close to the deceased. If the deceased's profile becomes compromised by an attacker, they could then send messages to everyone connected to the user asking for information or financial "assistance" relying on the relationship between the friend and the deceased. The friend may have no reason to question the request. Until the death is known and the deceased's profile transitions from Type A to Type C for instance, there are vulnerabilities. More research is needed regarding these transitions, timing and ways to protect content in these situations.

5   Conclusion and Future Work

The term thanatechnology, coined by [25] was a way to describe the multidisciplinary intersection of computing technology and thanatology. In the field of human-computer interaction, limited consideration is given to the content of deceased users when designing applications or the protection of the content long-term. Our view is that as more people use social media throughout their lives, we will inadvertently construct a

lifelong timeline through our profile which will most likely become our digital legacy (and thus our memorial). However, most social media users do not think about this or the long-term consequences of their actions in creating their legacy through social media. This then led us to research college student's perceptions of death and social media to create a set of guidelines in posting content online, merely to make people more aware. This also included examining the deceased person's final wishes in preserving (or not) digital content that they owned.

It is crucial to be mindful as the deceased individual would have no means of self-cleansing, auditing, or policing any misinformation of the profile to remove content themselves [26]. The idea was that education and awareness could make people more alert at making their final wishes known and to protect their digital content in the likelihood of their death [27]. Our work has significantly shifted since then as we have taken a more proactive and systematic approach in trying to protect the content of deceased users and to maintain the content to help the bereaved.

We have been working on a project named SADD, a Social Media Agent for the Detection of the Deceased, which is an agent-based computer program designed to automatically identify profiles of deceased users [28]. The goal was to find profiles of the deceased that may have been forgotten or unknown to family members (mainly for family members that do not use social media) in order to protect and preserve the content. Imagine that most of a person's photos and videos were only saved in Facebook or Twitter, to have the account deleted after a time of inactivity. Another goal of SADD was to flag these accounts to memorialize the pages so that other users could continue their online relationship with the deceased.

Currently, SADD can search Twitter for users tweeting a designated hashtag, for example, #RIP, then isolate the tweets for each user. Those tweets are then analyzed for trends or emotional cues from word choice, otherwise known as sentiment analysis. Individuals who have experienced a loss are identified and tracked for long term data gathering. Selected user's tweets are categorized as confronting or avoiding the tasks of grieving, based on the dual process model of coping. The publicly available Twitter data plus automated collection and analysis provide the ability for large scale collection for large sample sizes to identify markers for negative emotional stress. Potential issues with the methodology include verification and protection of user identity, sample population selection, and screening user's experiencing loss. Technical issues with the data collection include rate limitations on queries by Twitter, storage of tweets as large numbers of users are identified, and resource commitment for analysis.

Areas of further research would include networks of users and application of the model for groups of users providing insight into the effects of social interaction on the grief process. Identification of networks requires a rigorous definition of social networks within Twitter. The propagation of emotion through twitter networks can also be explored. We intend to expand the technical application of SADD and continue to explore social media in the context of death.

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