Life Editing: Third-Party Perspectives on Lifelog Content

Daragh Byrne[1], Aisling Kelliher[2] and Gareth J.F. Jones[1]
[1] Centre for Digital Video Processing, School of Computing,
Dublin City University, Glasnevin, Dublin 9, Ireland.
[2] School of Arts Media and Engineering, Arizona State University, Tempe, AZ 85281.
daragh.byrne@computing.dcu.ie

ABSTRACT
Lifelog collections digitally capture and preserve personal experiences and can be mined to reveal insights and understandings of individual significance. These rich data sources also offer opportunities for learning and discovery by motivated third parties. We employ a custom-designed storytelling application in constructing meaningful lifelog summaries from third-party perspectives. This storytelling initiative was implemented as a core component in a university media-editing course. We present promising results from a preliminary study conducted to evaluate the utility and potential of our approach in creatively interpreting a unique experiential dataset.

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Lifelog, SenseCam, storytelling, sensemaking, editing

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Human Factors, Experimentation

INTRODUCTION
We document our daily lives using a variety of forms and processes, including diaries, photographs, movies, status updates, and tweets. These captured moments and reflections allow us to engage with Socrates' exhortation to examine, interrogate, and reason about life events. The construction and exchange of stories about our everyday experiences is one of the primary sensemaking methods we use to find meaning in our lives. For some, this process is supported by professional third parties such as therapists, lawyers, and biographers who help us piece together fragments of our existence into coherent narratives.

Online social platforms such as weblogs, Facebook, and Twitter allow us to document our daily lives using new digital techniques. These digital formats demonstrate rich potential for considering our life experiences at whole new levels of scale and time, where we can receive near-instantaneous feedback from a global audience. Small form factor digital devices such as cellphones or Flip video cameras provide the means for easily capturing impromptu content, while experimental technologies such as the Microsoft SenseCam [13] introduce the possibility of extensive everyday documentation. Lifelogging technologies like the Sensecam have been employed in a variety of scenarios to offer the collection owner benefits in terms of self-examination, reflection, reminiscence, and sharing of past experiences [8,9,10,16]. Personal capture technologies and the lifelog data they collect clearly offer profound opportunities for insightful self-exploration [15]. The level of richness and detail contained within such collections also offer opportunities for learning and discovery by third parties, whether interested general audiences or motivated individuals situated across a range of professional practices [4]. Such an investigative scenario is the focus of our research, where we examine the direct or indirect value of lifelog collections to third parties.

Within this paper, we present an analysis of third-party exploratory and interpretive practices with lifelog data sets using a custom-designed storytelling tool. Storytelling provides a commonly understood framework for making sense of experiences and in this case, is proposed as a useful lens for exploring and interpreting a unique experiential dataset. We first explore how a diverse set of individuals can help us understand a variety of unbounded responses to a unique lifelog dataset. Findings from this investigation can then provide recommendations for the potential design and development of interpretive systems for specific types of professional or everyday practice,. In our research, we evaluate the examination and construction of storied interpretations of lifelog data in a provocative learning environment where the pedagogical focus is the construction and consideration of digital, media artifacts.

In this paper we describe the use of a custom-designed storytelling tool as a core component in an undergraduate media editing class. We present findings from a preliminary user study, including examination of the processes' of data selection and story construction, together with analysis of the reflections of study participants. We conclude with design recommendations, suggestions for future avenues of

research, and discussion of the general applicability of this work to archives of personal content.

BACKGROUND

Lifelogging

Lifelogging technology enables the capture of rich personal life histories through digital means and it has demonstrated utility in a wide range of domains [7,8,10,16]. Lifelogs contain huge volumes of data gathered from one or more modalities through a variety of complimentary techniques, tools and technologies [11]. These include SenseCam (see below); mobile and desktop content; geo-location; contextual sampling; explicitly captured photos or videos; and online social media, such as Twitter. While lifelogs show much promise in a variety of applications, they carry a number of practical challenges. The most obvious of these is their voluminous nature and as such, much of the research effort to date has focused on the management of vast repositories of past experience [9,11].

SenseCam

The SenseCam is a major tool for lifelogging research. Developed by Microsoft Research in Cambridge, UK, it is a small wearable device that passively captures a person's day-to-day activities as a series of photographs [13]. At a minimum the SenseCam will automatically take a new image approximately every 30 seconds, but onboard sensors can trigger more frequent photo capture. It captures the day indiscriminately resulting in voluminous collections which often contain undesirable artifacts such as blurring, noise or lensing effects [11]. Due to its orientation and continuous mode of capture, it tends to offer a distinctive and unusual viewpoint on personal activities [12,16]. The objective, and chronological account of past action may also facilitate new appreciations of the habitual and everyday [12].

Storytelling and Lifelogs

Storytelling has been previously explored within lifelog collections in a number of small-scale studies, for example [10]. Harper et al. [12] conducted a study with six participants manually composing narratives using one-week's worth of their SenseCam images, highlighting usefulness in reflection and reminiscence. In a follow-on study Lindley et al. have employed SenseCam archives in family based explorations in which small stories were co-created to explore a social context of use [16].

Given the relative novelty of the lifelogging domain, there are not many fully developed and comparable tools for narration, with much of the work to date relying on simple implementations or tangible, paper-based methods. There are however a number of related projects within the space of digital storytelling. The Confectionary application allows the construction of everyday rich-media narratives from content co-opted from a variety of sources [18]. It has notable parallels with the lifelog solution we employ, as it provides an authoring environment for the creation, arrangement and layout of two-dimensional spatial stories. Two-dimensional space provides a familiar and instinctual story composition fabric, and is a well-established form of both traditional and digital narrative [22]. Confectionary, like our tool, exemplifies this approach by providing a spatial canvas for creating patterned stories from aesthetically-presented media fragments. Appan et al. [1] explore the composition of digital narratives for everyday experiences using media such as photos, gathered during the user's day-to-day activities. They also provide a tool for everyday storytelling, however, unlike Confectionary, the presentation and authoring of that narrative is simultaneous; evolving through interactive exploration of the content [1].

Storytelling and Sensemaking

Storytelling is described by Walter Benjamin as the ability to exchange experiences [3] while Richard Kearney defines stories as the transformation of time from '*an impersonal passing of fragmented moments into a pattern, a plot*' [17]. Constructing patterned stories based on the experiences of another requires the development of a distributed framework that acknowledges the emergence of individual and social identity from the entire knowledge flow experience, including notes taken, media consumed, friends consulted etc. [5]. French philosopher J. –B Pontalis once wrote that "*one shouldn't write one autobiography, but ten of them, or a hundred because, while we have only one life we have innumerable ways of recounting that life to ourselves*" [21].

Such a monumental recounting exercise can be undertaken with the support of a third party, as evidenced in the practice of psychotherapists, biographers, lawyers and anthropologists. Designing tools and mechanisms for third parties to engage in active, constructive reflection on personal digital archives has strong potential utility in supporting such professional practice. A storytelling framework that embraces the *act of mimesis* helps to provide a breach between actual life experiences and life-stories allowing for the possibility of alternative perspectives through reflection. Kearney suggests that mimesis involves both "a free-play of fiction and a responsibility to real life", as the action moves from the text and back again in a way that enriches our understanding [17]. Our approach situates storytelling as the ideal sensemaking mechanism for tackling vast archives of disparate personal mediated experiences, and proposes an editorial approach of judicious selection, composition and framing as a purposeful creative constraint.

Pedagogical Context

Digital storytelling as a pedagogical approach occupies a significant place in learning environments, where the combination of creative and analytical inquiry provides a flexible avenue of exploration [14, 23]. Studies indicate that digital storytelling integrates significant student-centered learning techniques such as deep engagement, considered reflection and project-based learning [2]. In creating a computational tool for composing rich-media stories from personal lifelog data, considerable technical, aesthetic and ethical challenges must be addressed. Integrating these

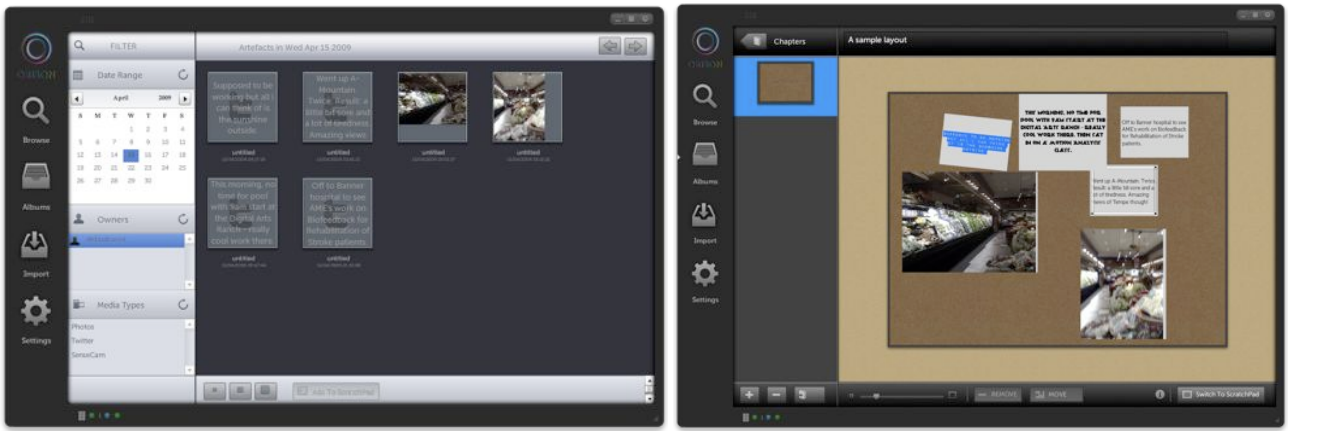

Figure 1. a) The browsing screen and b) the story chapter editing and layout screen.

challenges as meta-components in a learning curriculum provides a powerful scaffold for students to think beyond the specifics of their personal experiences towards a broader understanding of what it means to be human in a digitally captured world.

COLLECTION AND TOOLS

The third-party participants in this investigation were provided access to a lengthy lifelog dataset and a custom-designed storytelling tool developed as part of an ongoing research investigation into long-term multimodal lifelogs.

Lifelog Collection

Data from a previous lifelog collection effort was employed within this work [7]. While there are a number of content and contextual sources available for use within this research, it was decided to constrain the amount and types of information provided to class participants. From a much broader collection, three main content streams were chosen for use within this work, namely: passively captured SenseCam images, explicitly captured digital photos, and Twitter status updates. The decision to constrain a 2-year multimodal lifelog was dependent on issues of privacy and manageability. The duration was fixed at 9 months and the modalities limited to those most critical as the participants only had a concentrated amount of time to complete their work and it was felt providing the entirety of the collection would be excessively overwhelming. Several of the original modalities (e.g. SMS, call histories, email) contained direct or private communications with third parties and their inclusion raised potential breach of privacy issues for all corresponding parties. This was deemed an unnecessary risk by the institutions ethical review boards and the dataset was therefore constrained to those modalities considered most critical. A subset of 9 months provided participants a reasonably large, yet manageable dataset, where creative responses could still be developed within the timeframe of the study. While constrained it represents a more authentic set being broader in duration and available modalities compared with most previously employed lifelogs.

The content from a single long-term lifelog collection owner was provided with consent to the participants. The archive contained content between the 12th of March and the 21st of November 2009 inclusive, as follows:

SenseCam images: A set of passively captured images (sampled every 20-40 seconds) gave a rich visual diary of the individual's day-to-day activities. Over half a million frames were available but to avoid overwhelming the participants with repetitious images [11], the dataset was temporally skimmed to every 10th image. In total 53,000 images were provided to the participants. It should be noted that due to recording issues during the collection period, images were not available for much of August (5-24th incl.) and September (7th-23rd incl.).

Digital Photographs: To compliment the SenseCam images, a set of 301 digital photographs were also provided. The majority were captured in April 2009 where the collection owner had been traveling for three weeks.

Twitter status updates: A set of 'tweets' taken from the collection owner's public timeline were also provided to the participants. These 140-character text messages can be viewed as contextual annotations about items of interest or activities the collection owner engaged in.

Storytelling Tool

A storytelling tool developed as part of ongoing work [7] was provided to all participants within this investigation. The tool, dubbed Orison, supports the exploration of lifelog content and its arrangement into a story-based layout. It offers a complete cross-platform desktop application. The system was fully implemented having all of the expected behaviors and functionality of a media-editing tool from single click installation, to export and import which facilitated sharing of completed stories.

The software was designed based on initial probative and exploratory studies with the scrapbooking community and the method of digital storytelling enabled closely resembled that observed in these studies: album based two-

dimensional layouts. Additionally, the tool's workflow was intended to parallel their observed patterns and creative practices, albeit in a digital environment. Three primary actions were identified: locating information for inclusion in a layout (*browsing*); the arrangement of content into a working layout (*composition*); committing that layout to an album and situating it appropriately (*placing*). There are three major sections within the application, each relating to one of these functions.

When creating an Orison composition, the user first visits the browsing screen (see Fig 1a.) where they can locate content from the lifelog data by selecting a day of interest, and/or filter the content to display a single modality. The browsing options are deliberately kept straightforward and the presentation of content is kept conventional. Once the user finds content for their composition, they can move it to a working-space known as the scratchpad (see Fig 1b.) Within the scratchpad, they are given options to manipulate the content to create a desired spatial layout. They may for example, move and reorder content, adjust its size and rotation, apply a caption to the content, and style its appearance. The tool affords a large degree of control over the presentation of content, allowing any text to be resized or displayed in one of over 20 typefaces, and content to be bounded with either a customizable simple solid border or a predefined frame. When satisfied with their story layout, the user can move it from the working space of the scratchpad into an album, where it becomes a chapter. Each album can contain one or more chapters, which can be re-ordered as desired. A title can be specified and the arrangement of its elements can be adjusted at any point. Some layout examples can be seen in Figures 2 and 3.

INTEGRATION INTO PEDAGOGICAL CONTEXT

A new multidisciplinary undergraduate course in media editing at a large US state school provided an ideal learning context for evaluating the Orison tool. One of the authors developed and taught the course, which aims to move beyond tool teaching (e.g. a Photoshop class) towards a critical approach to the conception, production, publication and interpretation of diverse media artifacts. Students use a wide variety of free, commercial, open-source and custom designed software to tackle course assignments, in so doing, understanding the constraints and affordances that each tool brings to their process. Given the diverse disciplinary makeup of the class cohort, the course is designed to scaffold over a semester accommodating different student proficiencies and interests.

The class explores the core concepts of media editing (e.g. form, composition, rhythm, pattern, etc.) through 6 integrated modules (graphics, audio, movies, networks, interfaces, experiential) of increasing complexity. The final 'Experiential Editing' module provides students with a unique opportunity to take on the role of *life editor*, where in the words of master film editor Walter Murch they become 'the ombudsperson for the audience' [19], selectively revealing the salient life events of another. Using the Orison software and the provided lifelog collection, this assignment presents students with complex computational, artistic and moral challenges.

LIFE EDITING STUDY

Participants

15 study participants (13 male, 2 female) from the media editing course cohort agreed to participate in our study. Participation meant granting permission to the researchers to use their assignment content, descriptions of their work and analysis of such in external presentations. The participants represented students from all four years of undergraduate education and derived from a wide variety of disciplines including design (6), engineering (1), liberal arts (3), art (4) and film (1).

The participants were given some general information about the collection owner, but they had no extensive prior knowledge of the collection owner's life, friends, associates, or places in which he regularly spends time. A single participant had coincidentally attended a talk by the collection owner a year previously at the study site and data from this event was included in the collection.

The module assignment was used to evaluate our approach and was a required element for all students in the class, regardless of their study participation. All students were informed that participation was completely voluntary and had no impact on final grades.

Experiential Editing Module

At the beginning of the Experiential Editing module, participants were introduced to the concept of 'life editing' through a screening of the 2004 movie, '*The Final Cut'*. *The Final Cut* is set in the not-to-distant future where an implanted chip captures a complete audiovisual record of a person's life experiences. The main character, a 'cutter', is hired to review and edit this captured footage into a cogent movie summary upon an implantee's death. The Final Cut movie introduced the concept of life capture and editing, and also highlighted many of the features and considerations of life capture, such as being able to subvert lifelogging technology and the revision or re-conception of personal histories. Building on these ideas, participants were also assigned a variety of readings including [6]. Ideas expressed in the movie and assigned readings were used to seed discussion during a follow-up class seminar.

Methods

Participants were instructed on the setup and use of the Orison software during a classroom session. The participants were given one week to complete the following assignment: "*You will be "The Cutter" of someone's life experience. Using the data collected by an individual over a 9-month period, you will create an album(s) demonstrating insight into this person's life. Who are they, what have they done, how can we interpret their everyday encounters, how might they be remembered?"*

The instructor gave the participants a broad overview of the data collection, including how and when it was collected. General details about the collection owner were introduced. In addition to submitting their edited works, the participants were asked to provide a written reflection of their experience completing the assignment. The participants presented and discussed their work in a class critique session. The collection owner was present via video-conference, offering feedback and clarification about the validity and creativity of the students' story compositions.

Ethical Considerations and Practices

Given the highly personal nature of the supplied lifelog collection, a number of considerations for ethical best practice were put in place within this study. Many of these considerations were directly embedded within the software the students employed during this study. The system was designed to securely provide access to the content, and users were required to authenticate for each session of use. They were additionally required to formally agree not to publish or redistribute the content in any medium beyond the confines of the classroom.

Sharing lifelog content in this manner raises questions about privacy, both for the owner and captured third parties. We endeavored to minimize exposure through many implemented considerations. While not discussed at length here, deeper reflection of these issues is available in [20].

RESULTS AND DISCUSSION

The stories created by the students ranged in number, type, composition, style and strategy, reflecting the variety of competencies, skills and background of the participants involved. The 15 students produced 27 album-based compositions in total, with an average of 1.8 albums submitted per student (max 5). An album contained an average of 3.52 chapters (max 13.) In total 95 chapter compositions were created, of which 62 were given an explicitly title by the author. Each chapter employed approximately 8.36 artifacts from the lifelog, with a maximum of 32 items being used in a single layout. 66 photos (max 9, avg. 0.7), 672 SenseCam images (max 32, avg. 7.1), 56 tweets (max 10, avg. 0.6) were used, totaling 794 elements employed. 738 of those were unique, meaning only a small number of elements were repeatedly used across layouts.

General Findings

We discuss the types of stories created and then present the findings of the evaluation: we first explore *browsing*, discovery and exploration; next *ideation and composition* of a working layout; and finally the *placement* of a layout, framing within a story and reflection on completed works.

Types of Compositions Created

The created stories varied widely in terms of the aspects of the collection owner's experiences chosen and the storytelling point of view adopted. Not only was there a variety in the execution but also in the types and topics of the created stories. These were broadly classified into 4 major groups:

Time: Several albums examined chronological or focused accounts of a specific day or isolated episodes within the lifelog. These included for example, a detailed exploration of a 'typical' day, traveling and sightseeing. See Fig. 2a.

Biographical: These higher-level accounts examined the collection owner's life broadly from psychological and social perspectives or through exploration of evident trends and recurrent themes. They often considered encounters with people, places, objects or technologies and typically included authorial narration through captioning which exposed reflections on the owner's lifestyle. See Fig. 2b.

Expressive: These stories moved beyond the life of the individual in some way. They considered the aesthetics of the captured content, playing on colors and forms found in the lifelog content. In 2 cases, participants layered entirely new narratives on top of the existing content. In these cases the content and the real-world actors and settings were repurposed and re-conceived from the storyteller's perspective to tell a fictive account of an imagined happening. They also served as an allegorical reflection on aspects of the collection owner's life. See Fig 2c.

Investigative/Critical: These highly analytical and reflective compositions provided commentary on either the nature of the medium, the data or experience-editing project. These accounts used captioning to present explicit narration of the author's position. See Fig 2d.

Exploration of the Content

36% of all content used in the participant's compositions came from the first month within the collection (March 2009.) With 73% of all employed content being drawn from the first three months of the provided lifelog; 288, 176 and 121 artifacts originating in March, April and May 2009 respectively. While this appears to indicate limited exploration with participants emphasizing the earlier portions of the collection, this is not necessarily the case. These months were particularly busy for the collection owner with a lot of travel in April and thereby contained more non-habitual, and perhaps more novel content for use within compositions. As October 2009 – a month with travel and large amount of non-habitual activity - was the next most employed month (111 artifacts), this seems to reinforce that content was selected based on interesting activities rather than just shallow exploration. Additionally, the layouts were composed of artifacts spanning an average of 38.99 days (max 234 days.) This indicates that the participants were not just choosing easily assessable material, but carefully considering the media for inclusion, often surveying reasonably broad time-spans to identify the content appropriate to their story.

Observed Strategies for Way-finding and Sensemaking

The participants clearly perceived the volume of content to be a barrier to understanding and working with the collection. One participant commented that "*It was a little*

Figure 2. The types of story created. a) *Time* – A chronology of a single day; b) *Biographical* - An exploration of observed eating habits; c) *Expressive* – A fiction layered on the real world content; d) *Investigative/Critical* - reflections on technology

tough for me to get into because it was almost overwhelming to have such a wealth of information available to you and having to make sense of it and present it in a cohesive and logical way", while another remarked "*Never before have I been given the opportunity to look at someone else's life in such detail. It was a bit staggering at first."* While students often identified the topic of their story early on, they still experienced challenges in terms of locating content relevant and appropriate to their story: "*the only real struggle I had with the project was meticulously scrolling through each day-trying to find the right images I wanted to use with the project."*

Participants employed a variety of strategies to help them navigate the voluminous lifelog content and three predominant strategies emerged. First, and most simply, the participant heavily constrained the task by limiting the duration of exploration to a few days or a particular month of interest. This focused the task making it easier to find content. By doing so however, they consequently constrained the story they could tell to simpler forms and chronological accounts. The second approach was to randomly or in a semi-guided fashion jump to a location in the collection, with one student commented that this strategy worked well for his particular compositions: "*...randomly looking through them did however help me stumble on the abstract images...".* Finally and the seemingly predominant approach to locating content, was to explore the lower frequency modalities first (tweets and photos), ignoring the voluminous SenseCam images. This allowed the participants to build up an understanding of the events and identify the location of interesting items within the collection. One of the participants explains: "*I realized that by scanning through all the regular pictures, which were much fewer in numbers would be easier and most likely have more importance as they were actually chosen by the 'cuttee'. This turned out very effective...*" The tweets and photos - occurring relatively sparsely within the corpus - enabled the users to navigate to potential points of interest. In addition, the Twitter text content not only allowed for way-finding but allowed the users to gather a deeper understanding of the activity, its significance and its context: "*Some of the data was immediately obvious as far as what it was communicating however in other instances it was helpful to have access to the tweets to make sense of what was happening."*

Ideation and Composition

"Figuring out what to do with all of these images was the hardest part of this project by far."

In this section, we explore the very different approaches adopted by participants in their compositions, arrangements and in the focus and subjects of the stories they produced.

Patterns and Themes: Recurrent themes and patterns often formed the basis of the participant's stories. They examined the relationship of the collection owner to people, places and things encountered and the significance or bearing of them. Such stories were typically composed as an exploratory process, first identifying the major and salient themes within the archive and then identifying the most suitable elements for inclusion. The authors took care to minimize repetition and to carefully select content based on its aesthetics and appeal. One participant explains: "*As I was browsing through all the files on Orison, I found certain patterns...I decided to divide the albums into these three sections to make up the idea of this person.*"

On-the-Fly Creation: While some of the participants conceived their story upfront, several of the students took a less directed approach and ideated their story dynamically. The story iteratively evolved and was opportunistically crafted based on interesting items stumbled upon through exploration. One participant elaborates: "*I found it fairly difficult to do much planning because I honestly had little idea where I wanted to go with it. The challenge with this then was sifting through information as I went along and simultaneously determining what I wanted and how to build a narrative with it on the fly.*"

Aesthetics: The authors gave careful consideration to the attractiveness of the compositions, considering all visual aspects of content added to a layout: "*I tried to find the moments that 'looked the best' - images that captured smiles, or maybe interesting lighting, and also images that contained the most people in one shot.*" Many of the authors additionally spent a great deal of time applying background, frame, and text styles to the content within a layout (see Fig 3.) This was often done to visually reinforce the narrative being communicated. For example, in Fig. 2c a comic-book style was applied to underpin the fictive nature of the story.

Authorial Captioning: 65.3% of the created chapters were given an explicit title and 13% of the artifacts were given a

caption. They allowed the participant to communicate their perspectives: "*I used mostly [SenseCam] pictures, and then wrote my interpretation… and why they might have been important to that person*." In some cases, the author considered what that individual might have said and placed the caption in a first-person voice, thereby adding to the weight of the narration. The existing Twitter content, being authored directly by the collection owner, was used in place of captioning on occasion to achieve similar effect: "*Sometimes the tweets adequately framed what I wanted to express...Other times I did a little of my own interpretation of the provided images and added my own captions.*"

Integrity: For some of the participants the honesty, objectivity and integrity of the account was of paramount concern. They took on the mantle of the 'ombudsman of the audience', desiring to create an undistorted, unembellished and representative account of the life experiences. This had bearing on the compositions created, limiting them in the scope of what they could create and compose from the content. One explained: "*I finally decided on telling a simpler story that was more conceptual in nature. It seemed like the best way to present the data in a way that wouldn't skew or misinterpret it at all. Keeping integrity in the truth of his life was a major motivation for me.*"

Identification with and understanding of the collection owner

The high volume of content contained within a lifelog can be a significant obstacle to third-party understanding, however, it appears surmountable. Several participants reported a perceived understanding of who the collection owner was (*"...the more I considered it the more I felt it captured a decent amount of who I perceived [the collection owner] to be"*), with one of the participants correctly deducing roles and relationships of encountered individuals, thereby indicating some level of understanding can be built through exposure to the content. One participant initially offered that "*the sheer volume of SenseCam images picturing his desktop computer gives us a pretty good idea of how he spends the majority of his waking hours*" but later offers the following conflicting perspective "*there's no real way I'm going to know who this person is based solely on a few pictures, several tweets and a whole bunch of SenseCam images*". They suggest that while a lifelog can offer an objective account of activity, from which actions can be metricated and settings, scenes or actors discerned, truly understanding the owner at a deep level is challenging.

There are clearly open questions about how fully a life can be understood through objective data alone, how complete that data must be, and how much it can truly and honestly reflects the life, personality and traits of the individual in question. While, the question of a lifelog's ability to convey the nature of that person is open, we believe in order for the participants to have creatively, competently and reflectively transformed the information into a meaningful story, they must have demonstrated at least some holistic understanding and appreciation of that person's life.

Case Study

From the 15 students, we have chosen to highlight one of the participants in particular as we feel they exemplify many of the works, processes and considerations involved. The student in question was additionally selected, as they were themselves a scrapbooker. As the tool was oriented towards this community, this made them an ideal candidate for more detailed exploration. The participant was clearly intrigued and engaged by the task and produced 4 albums, containing a total of 16 chapter-based compositions. They employed 164 items from the lifelog (130 SenseCam images, 26 tweets, and 8 digital photos) spanning the full range of the collection, indicating it had been well explored.

Artistic Opportunities

"The opportunities for simply creating something artistic out of his experiences was intriguing." The participant was motivated by the opportunity to create aesthetically pleasing compositions which juxtaposed playful, experimental and artistic layouts with considered and reflective thoughts on the nature of the medium, the notion of life capture and the aspects of the collection owner's life communicated via the data (see Fig 3.) This observation is similar to that of Harper [12] and Lindley [16] who noted the construction of 'creative views' and the potential for playfulness in the compositions.

The Nature of the Media

Within the album 'Obscure' the participant ruminates on lifelogged media. In particular the compositions reflect many of the unique aspects of the SenseCam. Seemingly undesirable low-quality features of the SenseCam are well documented and include blurring, noise, light lensing effects and poor capture in low light conditions. Many of the students' compositions similarly noted this, but the participant does not just simply highlight but instead capitalizes upon the 'strangeness' [16] that can be seen in the SenseCam frames. These unusual artifacts of the capture technology facilitate creative compositions and were explored in chapters entitled *'Mystery'* (blurring), *'The Effects of Light*' and *'Colours in the Dark'* (see Fig 3.b).

The SenseCam may additionally highlight seemingly innocuous things making them more apparent. In the album 'Awareness: I Can See Myself!' the participant explored this in great detail; choosing to focus on 'Busy Hands' (see Fig 3.c). The position and infrared trigger of the SenseCam emphasizes capture of conversational hand gestures. The participant, noting this, dedicates an entire composition them. This again complements the findings of Lindley and Harper [12,16] that the medium allows for new appreciations of the ordinary and the everyday. Not only is there opportunity for understanding of the individual from lifelogs but by leveraging the unusual aspects of the medium wholly creative exercises and studies can also be enabled and empowered.

Thoughts on Life Capture

"*I feel as though I have insight into a stranger's private existence and I'm conflicted as to whether or not that is ok.*

Figure 3. Samples from the case study participant a) What would we do without the web - *The center of the universe*; b) Obscure - *Colours In The Dark*; c) Awareness I Can See Myself - *Busy Hands*

But I do feel like I know him after these hours I have spent with him in his car, office and house."

Despite the participant's keen insight and careful consideration of both the technology and the medium, they seem to have grappled with the moral and ethical implications of the technology. This is reflected in the compositions produced; which contemplate awareness of others within the space around the collection owner, the degree to which the owner might be aware of this, and the number of people encountered, while another explores missed experiences as a result of gaps in recording.

Significant Happenings

"It occurs to me that the reason for editing the events of one's life can be summed up in one word: significance. Different people will find different things about [the collection owners]'s life significant..."

From the point of view of the third party, it is not always about being faithful to an objective account of the individual's life, but the role of the ombudsman is to tease out what they perceive to be important and meaningful. The participant notes that this will undoubtedly change from person-to-person based on their values, perspectives and interests. The album *'Snipettes of a Life Well-lived*' is singularly focused on this idea, and the participant has distilled a number of events they perceive to be especially meaningful from their perspective. For example, the thoughtfully titled *'Only God Can Make a Tree*' appreciates the simple pleasure and beauty in a day spent in the park, *'Night Gems'* explores being indoors on a rainy day from an aesthetic standpoint, while *'We All Need Somebody to Lean On*' explores the importance of people in our lives and the regularity at which we encounter them.

Life Editing and the Learning Experience

This assignment was designed as the semester's most challenging and time consuming and the students responded in kind with evident enthusiasm and curiosity. Certainly, the novelty of the media and the custom-designed software piqued their interest, but their engagement in thoughtfully discussing the ethical, conceptual and technological implications of the exercise was beyond that experienced by the instructor in prior modules. A student described in his reflection text how his understanding of the scope of the endeavor developed over time noting "*what seemed like a simple project at first really turned into something profound once it was looked deeper into. We weren't just stringing pictures together to tell a story. We were actually given the ability to take someone's recorded life and reorganize it all in any way that we saw fit. Never before have we been given such an opportunity to take control of someone's life like this and manipulate the truth."* Recognition of the editor's level of responsibility to the material and the complex issues of power and control engendered were evident in several of the student's comments, with students writing that it '*was interesting to have control of the narrative of someone's life'* and yet another *"it was interesting that the program did allow us to sort of "cut" someone's life. It's still kind of a weird concept to me'*. Consideration of their comfort level with the role of life editor was a provocative topic of online and in-class discussion, as noted earlier in the case study.

In thinking more broadly about the Orison tool, one student noted their impression that the class cohort was *"more amazed about being able to use such a tool, and what it could develop into later on"* and how *"It is staggering to imagine what effects this will have on social development and interaction…Will things get to a point where it won't be necessary for people to physically update things themselves; their computers will be automatically updating for them?"* This form of reflection and projection closely aligns with the overall learning goals of the class, demonstrating ability to think beyond the tool and situating their constructions in a broader socio-cultural context.

DESIGN REFLECTIONS & RECOMMENDATIONS

In this section we reflect on the findings of this study and offer some recommendations both on how this and related tools might be improved to better support third-party use.

Ethical Considerations

Providing personal content to third parties requires a coherent ethical framework to protect the privacy of the individuals contained within the content.

Provoked Responses: Many of the study participants grappled with the ethical implications of accessing personal lifelogs. Such dimensions should be fully considered and feedback channels to address concerns provided.

Information Exposed: Careful consideration of what personal content and communications are exposed and how is required. It should also be remembered that while a

collection owner may provide consent, consent must also be obtained from all parties as many private communications and encounters are captured in lifelog data.

Mediating Access: Any solution must address ethical and privacy considerations by mediating and restricting access to content. We currently facilitate this through automatic roll-down of content updates and through a remote authenticated server architecture.

Lifelog Content, Affordances and Constraints

The study lifelog content was initially perceived as overwhelming. The continuously capturing SenseCam provides a detailed overview of ordinary day-to-day encounters. The SenseCam data volume, while unwieldy, facilitates a rich understanding of the everyday and enables patterns and routines to be discerned. Lower frequency modalities, like Twitter and photos are however captured with intent and remark on a moment of significance or interest to the collection owner. They each offer interesting and valuable opportunities for sensemaking from lifelogs and bring different fluencies and capabilities in contextualizing experiences and composing stories.

Data Discovery And Exploration

The Orison tool offered deliberately simple browsing strategies in order to facilitate this investigation. There is much need to better support content discovery and exploration.

Scaffold Understanding: The participants noted the utility of the lower frequency modalities in both identifying periods of interest and in contextualizing the activities. This feature should be exploited to support data discovery by scaffolding understanding through these modalities.

Highlight Interest: Ideation of the stories often emphasized particular times of interest, where non-habitual activities occurred. In order to facilitate data discovery, it would be helpful to explicitly highlight these as well as periods of particularly active or unusual capture.

Associate and Recommend: Stories were often conceived around a specific topic or theme but some participants struggled to identify content aligned to this concept. Computational techniques could associate content and enable suggestion of related content in response to a variety of requirements (aesthetics, relevance, similarity, contrast).

Aggregation**:** Many of the participants described being overwhelmed by the volume of content, so reducing its complexity would be advantageous. Presenting content aggregated around particular activities or centered on lower frequency content would significantly help in this regard.

Story Creation And System Support

Categories and Approaches: Four story types were observed (time, biographical, expressive, critical). The time and biographical formats took broadly similar approaches in the creation and composition of spatial narratives. As such, a third party could benefit from the provision of authorial support through programmatically provisioned guidance during their construction. The expressive and critical compositions, however, tend to be more unique in topic, arrangement, and visual style. Consequently, these compositions would be difficult to provision explicit authorial support for.

Planning and Ideation: Authors tended not to ideate a single layout in isolation, but rather explored for content relating to multiple compositions in parallel. While a working space is useful, the single container scratchpad provided failed to support the strategies of the users and needs revision to better support the observed behaviors.

Reflection and Captioning: The provision of narration is desirable requiring the third party to reflect on compositions under construction. Captioning was, however, used irregularly despite utility in communicating the end construct. It should be encouraged to increase narration and reflexivity in compositions. Currently captions are tied to content and more flexible support would be advantageous.

Templates: Many of the created works, and in particular the chronological accounts, repeatedly employed similar visual aesthetics and patterns of arrangement. Templates should be integrated to facilitate rapid layout of content in the regularly observed arrangements.

Applications and Domains of Use

Coarse Tool: We have investigated an unbounded tool suited to exploration by a diverse mix of participants. Unlike our study, most third-party explorations tend to be situated within a professional community of practice, for example, cultural anthropology, biography editing, therapy, etc. The tool could be used to stimulate, mediate and build personal, cultural and societal understandings within these domains with suitable provision and support for the strategies, practices and workflows which apply.

A useful tool for the everyday user: Equally there is the possibility to explore the potential of more conventional and prevalent personal content in third-party explorations. The low frequency modalities showed utility in organizing, contextualizing and sense-making with life experiences. Employing content from online social sources may offer enormous and more immediately accessible potential for motivated parties to explore individual, societal and cultural understandings with the Orison tool.

Artistic and Creative Potential: Our case study highlights the creative and artistic opportunities latent within third-party explorations of lifelog content. Unconstrained deployments could yield exciting possibilities in this regard.

BIGGER PICTURE & NEXT STEPS

We have explored the use of lifelog collections and content in a life-editing task set within a learning framework. This study represents a first of its kind exploration of the use of lifelogs with third parties and there are a number of potential avenues for future exploration. We will conduct a repetition of this study to gather additional evidence of utility in an educational context and to further establish the

comprehensibility of lifelog content to third parties. We also intend extending the evaluation framework to allow for comparison between the first- and third-person experience-editing. To do this, we will enable the Orison tool to allow participants use their own digital content.

In addition to this, there are many scenarios relating to third-party use of lifelog content that may be studied further as part of future work. These exciting possibilities include working with historians, archivists, genealogists and cultural anthropologists, who operate at a broader societal and cultural level, probing, identifying and preserving moments of significance from a third-party perspective. In the modern digital age, there is much need for novel tools to support these practices. Finally, at a personal level, the use of digital lifelog content in combination with narrative editing techniques may additionally offer new modes of support to professional third parties such as lawyers, therapists and documentary editors who already help us negotiate our past and imagine our futures.

CONCLUSION

In this paper we present a custom-designed storytelling application for constructing third-party stories from lifelog collections. Storytelling provides an ideal sensemaking framework for interpreting life experiences, whether as part of everyday or professional practice. We evaluated our implemented approach as a creative and analytical assignment in a university media-editing course. Study participants successfully constructed diverse, meaningful story compositions from a very large data collection and within a constrained time frame. This demonstrates the potential of our approach. The application of this research in a variety of professional interpretive life practices represents a promising future direction.

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