Personal Laughter Archives

Reflection Through Visualization and Interaction

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ABSTRACT

We present our ongoing effort to capture, represent, and interact with the sounds of our loved ones' laughter in order to offer unique opportunities for us to celebrate the positive affect in our shared lived experiences. We present our informal evaluation of laughter visualizations and argue for applications in ubiquitous computing scenarios including Mobile Augmented Reality (MAR).

CCS CONCEPTS

Human-centered computing~Human computer interaction (HCI); Ubiquitous and mobile computing systems and tools

KEYWORDS

Laughter; Visualization; Reflection; Mobile Augmented Reality

1 Introduction

Laughter is a fundamental human expression that is universally shared: from the young to the elderly, by any gender, in any language. Our laughter is ubiquitous as well as infectious. Despite being nonverbal, laughter is a rich social expression with each person having a distinct laugh that can carry subtle meanings [12]. As universal, omnipresent, and personal as it is, laughter is ephemeral. We typically do not think about laughter for its own sake, especially not about the sound of laughter. Yet what if we were able to capture and preserve our laughter and given an opportunity to reflect on it? While many aspects of our lives are being quantified in commercially available health apps (e.g., daily amounts of our walking, sleeping, heart rate, etc.), laughter has not yet been considered as a rich data source for us to reflect on how we feel nor understand our shared lived experiences.

In this paper, we describe our ongoing effort to capture, visualize, and enable interaction with ephemeral and intangible human laughter to offer opportunities for reflection. We report an informal evaluation of our laughter visualization and work-in-progress applications in ubiquitous computing scenarios including Mobile Augmented Reality.

UbiComp/ISWC '20 Adjunct, September 12–16, 2020, Virtual Event, Mexico

ACM ISBN 978-1-4503-8076-8/20/09.
https://doi.org/10.1145/3410530.3414419

Figure 1: A composite sketch that envisions laughter data overlaid onto a living space as seen through MAR. The green kelp-like squiggles represent laughter sounds attached to the place where they occurred and each squiggle represents the characteristics of each laugh.

2 Background

In our previous work [13], we developed an automatic laughter detection algorithm which uses modern convolutional neural network architectures to identify and extract instances of naturally occurring human laughter from any audio source (code, data, and trained models are publicly available at [6]). One application of such automatic laughter identification may be that smart speakers, such as Amazon's Echo or Google Home, could provide a service that selectively extracts, tallies, and preserves laughter from conversation. Over time, we may end up with thought-provoking cumulative data (e.g., who laughs the most and when in a household), the ability for us to recall some milestone laughter events (e.g., give me the laughter from my first day of school), surprise gifting of laughter (e.g., here is a giggle of your daughter from this date last year), and potentially simple life-affirming signs which could even serve as an alternative to emotional biosensing systems [8].

Over time, it would then be possible to accumulate masses of our loved ones' laughter. Beyond using the voice assistant interfaces on our smartphones or smart speakers as mentioned above, how might we interact with such archives of our laughs? An obvious solution might be to quantify laughter sounds with numeric values and create graphs and charts in the style of a quantified self. However, our previous research with participants has shown that a simple quantification (such as registering the number of "Likes" on Facebook or charts) does not seem appropriate for representing laughter. One of our participants who was presented with bar graphs of her laughter data told us, "It looks clinical. It makes me think that I did not laugh enough." The sound of our laughter deserves a nuanced representation that considers emotional sensitivity, which traditional data visualization marks may not provide. How might we design representations that better honor our personal and precious laughter? This led our research team to explore a number of representations and interaction techniques, both tangible [13] and visual (current work), which aspire to be analogous to artwork that encourages personal reflection. Preserving records of our laughter sounds via poetic representations was also inspired by prior work such as *Affector* [3] and intentionally *slow* displays [e.g., 4, 11].

Within the field of HCI focusing on ubiquitous computing and sensing, researchers have explored a variety of techniques to collect, classify, and make sense of the sounds around people [e.g., 1, 2, 9]. Our work is different from this previous work in that we focus on laughter, automatically detecting, extracting, and visualizing laughter within various social activities. In this paper, we focus on the report of our ongoing work to explore visual representations of laughter sounds and future application to ubiquitous interactive techniques with MAR.

3 Visualizing Laughter

In visualizing laughter, we encountered several design challenges. First, how might we visualize individual laughter in such a way that the viewer may distinguish one laughter "type" from another (e.g., giggle vs. belly laugh)? Second, how might we visualize a collection of laughter so that the viewer gets a sense of volume (whether there are many or few laughs) as well as a sense of time (which laughter happened earlier, later, etc.)? And third, how might we allow the viewer to move between the views, allowing for both a macro (the collection) and micro (details) view of the laughter archives? Examining laughter's basic acoustic properties, such as duration, volume, energy levels, and patterns, we have experimented with a variety of visual media and representations that enable flexible expressivity. We also looked for non-imposing visual representations that let the user focus on the sound of laughter itself and avoided overly distracting graphics. Some of the representations and visual metaphors we have considered include water ripples, fireworks, spider webs, etc. In the end, the medium our design team felt most fitting was watercolor as it possesses an expressive capability for movements and directions, as well as a space to manipulate explicit channels such as size, opacity of color, etc. to convey the unique, rich qualities of each laugh. Figure 2 shows some of our early designs with traditional watercolor. From these watercolor studies, we explored two different types of watercolor representations for laughter sounds.

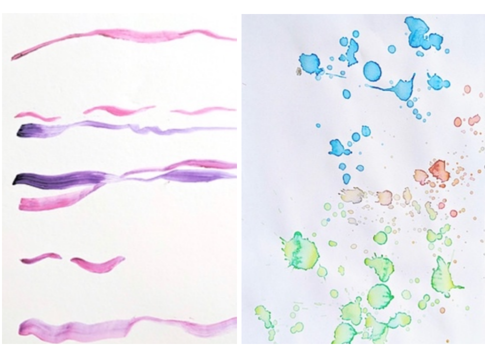

Figure 2: Watercolor studies, which helped us envision different types of laughs such as long vs. short laughs, bursts of laughter, soft giggle, single vs. group laughs, etc.

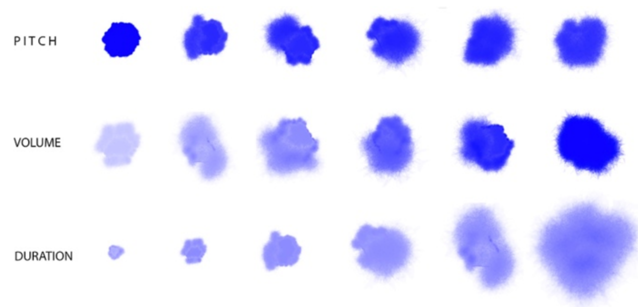

Figure 3: Watercolor blobs with varying visual treatments mapped to pitch, volume, and duration of laughter.

3.1 Watercolor Blobs

The first visualization was based on watercolor blobs or bursts, which we postulated would convey the burst-like, energetic qualities of laughter. We experimented with various mappings of the size, opacity, and irregularity of the watercolor

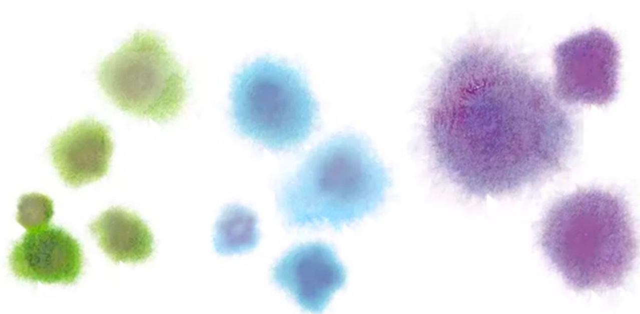

Figure 4: A collection of laughs represented with watercolor blobs. Different colors denote different speakers.

droplets to indicate duration, volume or energy level, and pitch [Fig. 3]. This design offered an appealing result whether there were many blobs or a few. Using d3, HTML, and Javascript, we developed an algorithm to extract audio data from each laughter clip and represent them in different ways. The algorithm for creating these paint blobs involved analyzing acoustic properties of a laugh at a given moment, creating a semi-opaque regular polygon, and then geometrically distorting it based on the extracted audio parameters. Then, the next second of audio was analyzed, represented similarly with varying transparency, and overlaid onto the former shape [7]. Each of the polygons was filled from a region of a hand-painted piece of paper to give realistic watercolor look.

3.2 Watercolor Brush Strokes

The second visualization focused on brush strokes, specifically the thickness, length, undulation, and opacity, to convey the characteristics of laughter. We created auto-generated, custom paint strokes using the same libraries and languages as the blobs. The strokes were comprised of a series of sequentially placed circles which vary in opacity, position, and size based on pitch and loudness data of a point in time of an audio source of a laugh [Fig. 5]. The length of the watercolor stroke represented the duration of the laugh. This resulted in lines that contained the delicate coloring variation of a watercolor stroke [Fig. 6]. In addition, we clustered the participant's laughter files into several groups and color coded them using an unsupervised learning technique from machine learning. Depending on the acoustic features the learning algorithm found significant in distinction, the color could be used for identifying speakers or different types of laughter. This ambiguity of categorization rules left room for interpretation that can provoke participants to reflect more deeply on the qualities of each laugh [5].

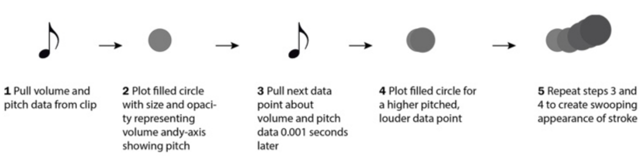

Figure 5: Process of auto-generated custom paint strokes.

4 Informal Evaluation of Visualization

In our informal observation with five participants, we shared our interactive laughter visualizations on a computer screen [Fig. 6] and invited them to explore freely. In this screen-based version of our visualization, laughter could be browsed chronologically or by individual speakers denoted by colors (e.g., all laughter in green belonged to one speaker). The participants were able to select laughter by different speakers and listen to both individual and groups of laughter animated on the screen

Overall, the participants enjoyed seeing laughter animated on the screen as they described that the laughter sounds "come to life," even though the sounds they interacted with were not their own or their loved ones' (the sound used in our evaluation was

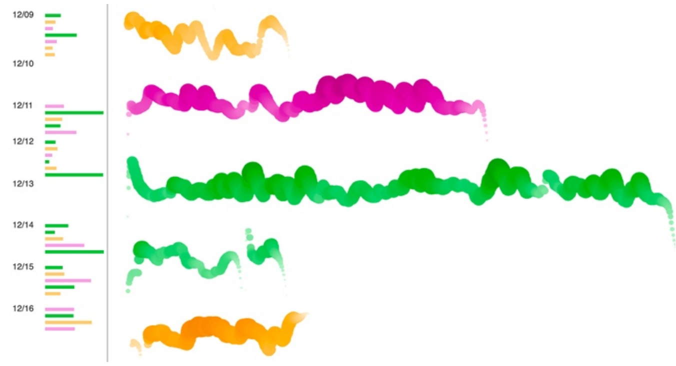

Figure 6: UI with a collection of laughter represented with watercolor brushstrokes. Different colors denote different speakers.

pre-recorded from our previous study [13]). In terms of the different types of visualization, the participants felt that the brush strokes with dynamic movements and more distinctive shapes felt more natural and easier to understand as a visual representation of laughs. While the blobs seemed poetic, participants felt that the blobs were less intuitive because it was more difficult to understand which aspects of the blob visualization were mapped to which variables of laughter (e.g., "Does the size of the blobs correspond to volume or duration?").

Beyond how the different types of laughter visualization were perceived, one of the most valuable feedback we have received from the participants was how they felt about the overwhelming quantity of laughter sounds available and the effectiveness of this particular interaction. Interacting with and listening to every individual laugh in the archive would be exhausting and impractical (especially if the archive size grows into the hundreds or more). The participants therefore felt that the experience of exploring the laughter on the screen could benefit from having "landmarks" to help them first orient themselves and explore further. Organizing laughter chronologically or by speaker type did not seem to be enough for orientation and to invite curiosity to play around with large amounts of laughter sounds. The participants felt that it needed some additional type of label or landmark such as personally meaningful locations or past events to provide emotional context and help them navigate a thought-provoking journey through the laughter. This led us to consider our future work which involves MAR as a display and interaction technique with laughter visualization more directly rooted in our physical environment.

6 Work-in-Progress and Future Work

In order to invite more exploration and inspire a journey through the personal laughter archive, we are currently expanding our visualization to go beyond the desktop using MAR. Our current automatic laughter detection classifier is light enough to run on a smartphone [6], therefore, automatic identification and collection of laughter can happen in real time and anywhere. Our work-in-progress includes exporting our laughter visualization to Unity as three-dimensional animated sculptures which could be overlaid in our physical environment using AR and MAR. We are adopting the metaphor of watercolor brush strokes to contextualize laughter in augmented reality. Modeling laughter in a 3D space opens up more dimensions for visualization and interaction. For example, we could use different shaders and textures in Unity to represent the type of laughter (e.g., belly laugh vs. chuckle), and invite participants to walk closer and explore. One could also reach out and interact with the laughter (e.g., touching the 3D texture to activate the laughs). Using Maya as our main prototyping software, we are iterating through several designs.

Participants in our past study have mentioned that listening to loved ones' laughter offers soothing, therapeutic qualities. To expand on this finding, one possibility is to intentionally create a calming meditation space with laughter interaction. This may manifest differently for different users, yet one idea using state-of-the-art head-mounted AR devices such as *Magic Leap One* [10] might involve our spatial animations resembling foliage, such as a gently swaying fields of tall grass, or the slowed motions of underwater plants like kelp, or an even slower motion which can only occur on an alien planet with a fraction of the earth's gravity (e.g., in the style of *Tónandi* [10]). These spatial animations may resemble familiar objects and borrow from real-world metaphors but may also not, creating a dream-like augmentation of the user's world, emphasizing the semi-magical experience that would come from visualized laughter.

A more readily accessible system would be a portable laughter tracking and visualization system. Similar to systems that geotag our photos, a mobile tracker could tag our laughs over time and display a personal historical map that shows where we laugh the most in our daily lives. Either a head-mounted or handheld, advanced MAR display device could offer extended spatial interactions for this map of laughter. A family may enjoy a virtual "laughter forest" growing out of their living room, revealing family members' laughter rooted at a physical "birthplace" for each laughter (Fig. 1). In another, the sounds of a baby's laughter where she took her first steps may be seen and heard in a corner of the living room marking her triumph. A college student walking around his apartment through the lens of MAR may notice substantial amount of colorful laughter sculptures clustered around the dining table while less laughter appears in the reading room. This application offers users a new perspective to reflect and interpret mundane domestic environments. In an outdoor setting, through the MAR display, we may visit our favorite park and see it covered with virtual trees of laughter representing laughter sounds collected at different places in the park. We hypothesize that this expansion of our laughter visualization through MAR could invite more curiosity to explore more laughs than through a desktop experience as well as provide a more contextualized personal reflection with the sounds of our laughter.

7 Conclusion

We have shown our ongoing work to capture, represent, and interact with laughter sounds in order to provide unique opportunities for us to reflect on our laughter. We emphasize that this work is about recognizing laughter, an often overlooked yet evocative expression, as a record of our lived experiences once shared with our loved ones. Something that could be preserved, revived, revisited, and cherished. We have presented our informal evaluation of laughter visualizations and presented our ongoing work to expand the visualization to MAR. We are not claiming that these are the ultimate representations for and interacting with laughter sounds. Rather, through this work, we demonstrate that nuanced, artistic, and contextualized representations are possible to invite reflection with the sounds of laughter.

ACKNOWLEDGMENTS

We thank our participants and our colleagues, Noura, Jon, David, Coye, Max, Jeremy for their insightful discussions.

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