

Yarn: Using Personal Data to tell Stories of Accomplishment by Aligning Shared Content with Sharing Goals

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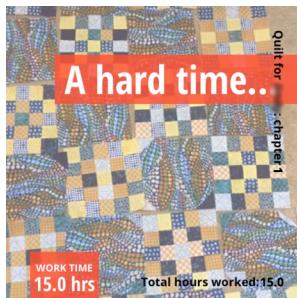
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As I start my story, I thought I would give a summary of where I am in the process. I began planning a quilt for my husband on July...



Since I don't have time to quilt during the week, I have to make due with online shopping. Liked my idea of a Kelly green backing for the...



Finished the checker border and 4 strips of 9 main body rows! My mom helped me to decide to add strip of dark fabric between the...



I finished piercing all blocks in the main section! Now I have cut the divider and attach it and the border to the main section. Getting closer!

Figure 1. Yarn helps people create content which aligns with their goals for sharing personal data through a guided authoring process with visual templates and description prompts. Content shown was created by field study participant F2^{diy}, a story of making a quilt.

ABSTRACT

People often do not receive the reactions they desire when they use social networking sites to share data collected through personal tracking tools like Fitbit, Strava, and Swarm. This is due to a mismatch between the reasons people want to share personal data (e.g., to share progress, get feedback, ask for help) versus the content shared by current tools (e.g., raw numbers, maps). To help people tell better stories of progress towards accomplishments, we design an interface to align reasons for sharing with the content that is shared. Motivated by formative interviews and prior work, we explore how text prompts, visual templates, and highlighting of cumulative effort can impact sharing and the experience of tracking. We validate this approach in Yarn, a mobile app for composing and sharing stories of accomplishment with collected data. 10 participants used Yarn for 4 weeks, reporting that Yarn helped them monitor their accomplishment progress and create content they wanted to share.

Author Keywords

Personal data; personal informatics; storytelling; social sharing; self-tracking; social networking sites.

ACM Classification Keywords

H.5.2. Information interfaces and presentation (e.g., HCI).

INTRODUCTION

Devices and apps for tracking personal data are becoming pervasive, including Fitbit for activity, Mint for finances, and Swarm for location. These apps often include social features to allow people to celebrate achievements, ask questions, or receive support. Although sharing data with others who collect the same data is common (e.g., leaderboards on Fitbit, Spotify's friends feed), many commercial tracking apps and research prototypes also support people in reaching broader audiences of friends and family unfamiliar with the data being tracked (e.g., [9,38,39]). Many apps include features for sharing recent activity to social networking sites (e.g., Facebook, Twitter, Instagram) and via direct communication (e.g., email, SMS).

People share the data they track by asking questions, reaching out for support, or celebrating achievements [13,35,40,47,49]. However, apps rarely help people create content audiences find interesting enough to respond to, so these requests often go unanswered. People find content uninteresting for two reasons: what is shared does not explain people's sharing goals, nor does it connect to the broader story of why the data is being collected. Most systems support sharing system-generated content, such as an update or a numerical summary (e.g., "Julia is listening to U2", "Elliott took 8,423 steps today") [13]. Though some systems support adding text or personal photos to system-generated content, what is shared rarely offers the necessary context to explain why a moment is an achievement, what advice is needed, or how to provide support. People often collect data as part of a story in everyday life, such as trying to lose weight or save money

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[22,43], but these motivations are rarely surfaced. In a review of people's social needs for personal tracking, Kersten-van Dijk & IJsselsteijn suggest “*to move beyond impersonal, standard messages to fostering true connections between self-trackers and their various audiences, [designs] need to support those users in telling their story and sharing experiences with their data, their way*” [22].

This research explores how to help people create interesting and shareable content from their personal data. We demonstrate approaches to help people align the data-driven content they collect with their motivations for sharing and connect it to a broader story. We develop a mobile app, Yarn, which implements a guided experience of authoring story chapters to help novices quickly create compelling and personally meaningful content they can share. The guided experience uses *visual templates* and *description prompts* to help people clarify their sharing goal and describe how others can help towards it. For example, a visual template for celebrating achievements emphasizes the intermediate steps toward completion of the story (Figure 1), while a template designed for eliciting support emphasizes the difficulty of the current moment. Description prompts encourage people to explain why a moment was particularly important or difficult.

The plots of the stories people tell tend to follow basic themes [2], such as a journey and return to the same place (e.g., sharing photos from a vacation), or overcoming a struggle (e.g., fighting cancer). We focus our investigation on one specific plot, supporting *stories of accomplishment*, because people often track moments toward that accomplishment to monitor progress and stay motivated. Examples of accomplishment stories include saving money for a big purchase or learning a new skill. We specifically designed Yarn for two accomplishments involving different tracked personal data of interest to the HCI community: completion of a running race and of a home Do-It-Yourself (DIY) project. In race training people may track their running distance, heart rate, or pace [9,37], while in DIY projects people may instead collect photos, expenses, or mood [44,45].

In a field evaluation with 10 people using Yarn for 4 weeks, participants reported Yarn helped them stay on track with their accomplishment stories and create content they were excited about sharing. In this work, we contribute:

- An understanding of how people want to tell stories of achievement online through personal data. Specifically, people want to share stories as they happen chronologically, including situationally-relevant data.
- Design strategies for aligning the personal data shared in moments to people's goals for sharing personal data. Specifically, we create a guided authoring experience consisting of visual templates and text description prompts to help people to share more interesting content related to their goal and connect that content to their story.
- A mobile app implementation, Yarn, demonstrating the design strategies for aligning shared content with sharing reasons in the context of a mobile app.

- Insights from a field evaluation of Yarn. Specifically, we find the act of collecting and curating data held people accountable to making progress on their story. The visual templates and description prompts in Yarn helped participants generate content they wanted to share.

BACKGROUND

The design strategies we identified and implemented in Yarn are based on people's motivations for sharing personal data and strategies used in other designs to support storytelling.

Reasons for Sharing Personal Data

In HCI, personal data has been used to refer to digital items people collect and retain about themselves (e.g., personal photos or videos for reminiscence [17], personal informatics data for self-understanding [27,28]), items on digital devices owned by a person (e.g., work files, emails [50]), or anything digital generated by the person (e.g., social media content [15,20]). There is no widely agreed upon definition of personal data [51]. We treat personal data as anything people intentionally collect and retain about themselves, with an emphasis on data digitally-produced (e.g., photos or videos, GPS traces) or digitally-logged (e.g., a journal app). Though people typically collect personal data for their own use, they sometimes seek to share the data they collect.

People often share to get *recommendations or advice* [35]. Providing advice is often the primary goal of peer support communities, such as for health [31] or overcoming cancer [47]. As part of these communities, people often share personal data to give context (e.g., biometrics associated with progress, photos of weight loss) [21,47]. People describe the practices which have worked for them to give advice to others.

People also share their personal data for *emotional support, motivation, or accountability* [49]. For example, Chung et al. describe how people follow hashtags on Instagram to find and receive support from others with similar health goals [6]. Participants then used those hashtags in their own posts, and felt guilty whenever they did not post something they ate or posted something which was unhealthy.

Finally, others use personal data to *share an achievement* they are proud of [54]. In these cases, personal data can serve as a record or better explain the achievement, such as a location trace from a race or photos from an artistic project [14]. Some people do this to curate an impression of themselves (e.g., as an adventure-seeking person, as a healthy person) [18,54]. Others share to become more connected with their sharing audience [52].

Commercial and research apps have used a variety of features for supported these sharing goals. Some seek to create communities within the app or platform for sharing ideas and opinions [23,42]. Apps around physical activity data often seek to create competitive communities, such as leaderboards [7,19,29] or daily challenges [12]. Sharing the data alone is often enough in these communities because the community has shared context about common challenges or accomplishments. For example, a running community

understands the accomplishment of a long training run, a diet community understands the struggle against temptation.

Some apps for collecting personal data enable reaching people not using the app through broader social networking platforms like Facebook and Twitter (e.g., [38,39]) or through direct communication via SMS or Email (e.g., [30,38]). Commercially, running apps like Nike+, Strava, and RunKeeper enable sharing routes ran or photos taken on the run annotated with information about distance and pace. This approach of sharing to broader social networking platforms enables people to reach and get feedback from a broader group of friends and family.

However, designs often struggle to help people convey why they are sharing to these broader communities. As a result, people often do not receive the response they hoped for, or any response at all [13,38]. This occurs partly because many apps automatically push data to these social platforms when it is collected (e.g., when food is logged in MyFitnessPal or a run is logged in RunKeeper) [5,13]. Though some apps support adding text or photos, these fields are rarely used. When they are used, people often use them to describe what they did rather than to ask others can help [13].

Strategies Used by Designs to Support Storytelling

Storytelling strives to make information understandable, meaningful, and memorable [32]. Yarn leverages design strategies for storytelling to help people create meaningful and memorable content. The HCI literature has a rich history of understanding how to design to support people in telling compelling stories. We focus our review on the strategies used by designs which integrate personal data into stories.

One common design strategy is *a guided authoring experience* which conveys how experts organize their stories. For example, the Motif system surfaces what video shots will help create a good narrative structure, helping people capture and assemble video stories in the moment [24]. Other systems help people organize photos and videos taken previously into a story. The iTell and Storied Navigation systems use prompts to help people effectively brainstorm what they want to highlight and organize any associated data [26,46]. Other systems have instead explored how to help people search within the photos, videos, and location data they collect for relevant or memorable moments. The classic MyLifeBits system included a map and calendar for browsing location-tagged photos [16]. The Raconteur conversational agent mined text conversations with a friend to identify what photos or videos may be appropriate to share [3].

Other designs seek to help people *document the important moments in their progress*, aligning with Rooksby et al.'s documentary-driven tracking style [43]. This record helps people tell the story of their progress after completion or get advice along the way. For example, the Mosaic system helps people share creative works-in-progress for early feedback [23]. Spyn supports documenting the experience of knitting through photos and location data in part to help people share the story of how they made progress [45].

Recently, prominent social networking platforms including Instagram, Snapchat, and Facebook have added story features aimed at sharing events currently taking place. In these features, people tend not to worry about whether content will be interesting because it is ephemeral and reading is voluntary [33]. When looking specifically at stories of accomplishment, designs can offer more specific guidance on how to make interesting content. Knowing someone's goals, and what progress they have made, can help people make content which better describes the importance of an achievement or explains a struggle.

FORMATIVE INTERVIEWS

Prior work has identified people's motivations for sharing and strategies for telling stories with personal data. We sought to better characterize the stories people wanted to tell with personal data before narrowing our scope to a specific type of story. We interviewed 16 people in their homes (9 F, 7 M, ages 25-40). We asked them to describe the personal data they collect and brainstorm the stories they were interested in telling through that data. Interviewees then completed a design activity where they sketched on paper how they would want to tell that story. We then asked follow-up questions based on the designs they drew. The first author conducted all of the interviews, taking field notes and recording audio, sending the audio to an external service for transcription. They wrote memos to summarize themes, describing and explaining themes with participant quotes.

The majority of stories people wanted to tell aligned with three classic narrative plots [1,2]: voyage and return, overcoming a monster, and quests (referred to as *stories of accomplishment* in this research). People telling voyage and return stories wanted to share a trip that they took through places and photos. People telling stories about overcoming a monster shared how they used personal tracking to help overcome a personal struggle, such as health problems. These participants shared their method for tracking to help others overcome the same challenge. Finally, people told stories of accomplishment to describe a journey to achieve a goal, sharing their progress along the way with relevant data.

We decided to design for stories of accomplishment for several reasons. The design needs for telling voyage and return stories have been comparatively well-studied through research on photo-sharing practices (e.g., [34,41]) and commercially in features like Google Photos vacation albums [36]. Participants felt that stories about overcoming a monster were very personal, best told in-person to close connections rather than online. Sharing tracking materials instead of tracked data also poses additional design challenges, and is a promising area for future work.

With our focus narrowed to stories of accomplishment, we considered a variety of different specific accomplishments. We opted to support the process of training for running races and completing home DIY projects. We selected these two as dissimilar examples involving different personal data. Race and DIY accomplishments have a long history of study

and design in HCI (e.g., [9,37,44,45]), making them good examples where technology may be desired or useful.

With a plot and two domains selected, we sought to better understand how people want to tell those specific types of stories. We interviewed 7 people: 3 people interested in telling running stories (2 F, 1 M) and 4 interested in telling DIY stories (3 F, 1 M), ages 27-35. These participants had all either recently completed or were in the middle of the accomplishment. One race participant was training for their third half marathon, while the other two were training for their first full marathon. DIY projects included a table, a dollhouse, a bookshelf, and a living room renovation. We followed a similar protocol to the previous interviews, framing the interview around their accomplishments and asking participants to design for that story. The first author coded and analyzed all interviews. We quote participants with I1-7, with a superscript for type of story (e.g., I1^{run}, I2^{diy}).

DESIGN PRINCIPLES

We describe three design principles from interviews and prior work: align shared content with sharing motivations, highlight important moments, and include situationally relevant data.

Align Content with the Reasons People Want to Share

People often do not receive the interest and response they hoped for when sharing personal data because content is shared without context explaining its importance, often just as a numerical summary [13,30,38,40]. Prior work suggests that designs can also automatically add context cues derived from other sensing modalities (e.g., location, mood) [30] or comparing against previously-tracked data (e.g., a personal best) [13]. Designs can also highlight how the personal data contributes to someone's overall goal (e.g., progress toward weight loss or a weekly step goal) [38,39]. Simply including the ability to comment or explain numerical data can help people explain context [7]. Designs can further offer description prompts to encourage people to explain why they are sharing or what feedback they are looking for [13]. The personal data can also be presented in a more interesting and visually appealing way, such as in a graph or animation [30] or supplementing numerical data with photos or videos [13].

People share for different reasons with different groups of people. Consistent with prior work on communication channel preferences [48,53], some participants only wanted to share with close family, while others preferred sharing once they accomplished their goal. I5^{diy} imagined keeping most moments private, but shared her finished dollhouse on Facebook (I2^{diy} and I4^{diy} did the same with their projects). She said, “*I only shared the process photos with my husband and my mom. I feel like the process isn't probably that interesting to other people. Maybe it would be, but from what I've talked with people they like to see the final thing.*” Other participants wanted to share important moments along the way, but felt most would not find the progress interesting.

Divide Stories into Chapters, Highlight Important Moments

Prior storytelling designs encouraged explaining events chronologically [24,46]. 6 out of 7 participants wanted to

present their stories chronologically to others, reflecting how they experienced the story. I5^{diy} felt her story “*would just inevitably be chronological... I would never deliberately try to organize it differently.*” Participants drew timelines, calendars, and infinite scrolling to represent this ordered view. Only I4^{diy} imagined another approach, grouping her home renovation by activity (e.g., painting, plastering) rather than the chronology of each room. Interviewees imagined they would write chapters whenever they made progress. Race training interviewees tended to run a couple times a week, while DIY interviewees tended to make progress in longer stretches of time over weekends.

Participants felt there were many chapters which they wanted to document, but were minor contributions to the overall story of accomplishment. For running stories, I1^{run} suggested “*some runs are more memorable than other ones.*” He explained that setting can influence the importance: “*if you're doing a run that's in the dark in Christmas time when everyone is decorating the city and you go running. That's different than your Tuesday morning run where you force yourself out of bed.*” I5^{diy} felt there was no need to highlight chapters which were similar to other chapters. She said, “*I wouldn't want to see is like repeated steps. I cut wood. I cut more wood. I cut more wood. I painted some and I painted some other things. I painted these. It would be different if it was like, 'I painted and then I put a sealant on it and then this other coat or something.'*” These findings align with prior concerns around sharing trivial accomplishments [10,13,38].

Participants did not want minor chapters discarded, as they still contributed toward the accomplishment. Despite that feeling many of his runs were minor chapters, I1^{run} felt that “*the most important aspect to convey to people who are not runners is the level of commitment that this takes... Totals are cool to me, how many miles did you run for this marathon, how long did it take.*” I1^{run} suggested a design could aggregate and present the total distance he ran to explain the effort to others, aligning with how other storytelling designs enabled people to track their cumulative progress [45].

Include Situationally Relevant Data, Aligning with Lived Experience

All three running story participants imagined including the distance or route with each chapter, then other data types as appropriate or as available. I7^{run} wanted to take a picture of each run, with other data in a box overlaying the image: “*then, this box would be data. I would want to share the distance, and then optional, duration, pace.*” All four DIY participants included one or more pictures in each chapter. Table 1 describes data types participants mentioned.

Participants were mixed on whether it was necessary to include a text description. All DIY participants felt descriptions were necessary to “*explain what that picture demonstrates*” (I2^{diy}). I1^{run} and I7^{run} felt it would be too burdensome to include text for each chapter. I6^{run} thought text might help someone with whom she shares her story. She felt prompts could encourage her to write a short description.

Race Training Suggestions

- Distance, route (I1*, I6*, I7*)
- Text Description (I1, I6*, I7)
- Photos (I1, I6, I7*)
- Pace or time (I1, I6, I7)
- Weather (I6, I7)
- Emotion (I6, I7)

DIY Suggestions

- Photos (I2*, I3*, I4*, I5*)
- Text Description (I2*, I3*, I4*, I5*)
- Expenses (I2, I3)
- Places visited (I2, I4)
- Emotion (I3, I5)

Table 1. Participants had suggestions for data they wanted to include in each chapter. *Indicates data they would expect to always include, without indicates optional or as-available data.

Participants felt other data types would be situationally interesting or useful to include. Some information, like pace for running, was dependent on audience. I1^{run} felt non-runners “*might not understand... if a ten-minute mile [is] fast or slow.*” I1^{run} agreed, instead opting to share how she felt with her non-running friends: “*one thing that the friends I don't tell my pace mileage to, some of them I will talk about more of the emotional side of training, because I think there's some good metaphors and some good lessons.*” Participants felt other information could be added as appropriate. For example, I3^{diy} felt it might make sense to include expenses when sharing a chapter about a big purchase toward her home maintenance. I7^{run} felt weather could be appropriate if it affected the run she decided to do.

There are many opportunities where progress toward accomplishments stories can go awry. Much like people track as part of their everyday lives [14,43], their stories intersect with their everyday lives. I6^{run} wanted to describe when something came up preventing her from running as planned (e.g., temporarily *lapsing* in her story due to skipping or suspending [14]): “*it'd be good to have something so you can explain any setbacks, too, because realistically, this is like the training plan, but sometimes you get sick this week and you don't run... injuries would be good to have on there, illnesses. Life stuff, like if you get busy at work and you're working 80 hours that week or something like that.*” Participants described emphasizing text and/or photos in these chapters to describe their setbacks.

THE DESIGN OF YARN

We designed Yarn for people without storytelling or design expertise, aiming to make adding to a story as easy and quick as possible. We focus on the mobile platform (iOS) to reduce the number of steps between collecting data (e.g., taking photos, logging a run) and telling the story. Yarn automatically gathers as much relevant content as possible (e.g., runs, weather). Yarn automatically composes chapter data aesthetically using visual templates. Finally, Yarn automatically sizes chapters by inferring importance.

The home screen of Yarn lists all the accomplishment stories on which a person is working. Clicking on a story brings up a chronologically sorted feed of the chapters in the story (Figure 4). To add a chapter, a person chooses what data to log and then selects a visual template. The supplemental video demonstrates creating a chapter in Yarn.

Support Choosing Appropriate Data to Collect and Share

We categorized the data type recommendations given by our formative interviewees (Table 1) based on how the data is

DIY Interface

Title What did you do today?

Description What problems are you encountering? What do you need advice on? How can others help you?

Photos & Videos



Date Saturday, May 13

Mins Worked 60

Expenses 0



Figure 2. Yarn supports logging five categories of data. To ease the entry process, Yarn automatically infers fields like date and distance based on selected photos or runs and offers writing prompts for description fields. Content shown is illustrative.

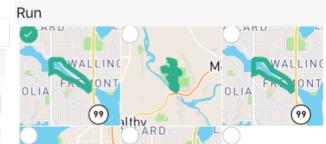
typically presented (e.g., as an image, as a number, as text) and the importance of that data to the story. We included five categories of data a person can log in Yarn (Figure 2):

- **Visual data:** a visual indication of what progress was made toward the accomplishment. People often find visual data such as photos more interesting than just text and numbers [13]. In DIY projects, photos and videos comprised the visual data. Race training stories also included route maps as visual data.
- **Numeric data:** any numeric measurements of progress toward the accomplishment. We selected *primary* and *secondary* fields based on how formative interviewees imagined tracking their progress. We selected time worked and expenses as the primary and secondary numeric fields for DIY projects, distance and time for race training. We considered supporting a percentage of progress (e.g., how far along a DIY project is, percentage of planned miles in a race training routine), but opted for time because it is easier to monitor and is not subject to changes in plans (e.g., a project being less far along than anticipated, more or less training required).
- **Description data:** a text title and description of the chapter. Yarn provides a few suggestions for what might be interesting to write about in these fields.
- **Minor data:** data which may be contextually interesting in a chapter but is only loosely associated with an overall measurement of progress. Drawing from our formative interviews again, we included weather information in race training stories and emotion in DIY stories. These data may help explain a moment (e.g., why a run was hard, what is important to learn from a DIY picture), but might not have a strong influence on how the story progresses.
- **Date:** when the chapter being logged occurred. We include this field to allow people add chapters after the moment.

Running Interface

Title How was your run?

Description What do you want others to know? How can others support you? What do you need advice on?



Photos & Videos



Date Saturday, March 4

Dist (mi) 3.21 Time (min) 29





Figure 3. Yarn’s templates were designed to support a motivation for sharing personal data surfaced in prior work. Template (a) targeted requests for *information or advice*. Templates (b) and (c) aimed to solicit *emotional support*. Templates (d), (e), and (f) were designed to support *sharing an achievement*. (g) supported minor, typically-unshared moments. Content shown is illustrative.

We made all data fields optional in Yarn. As suggested in prior work, we connect with other apps where people collect data to ease the process of creating chapters [8]. Photos and videos are loaded from the camera roll. Runs are imported via the Strava API¹ for race training stories, with weather via the Dark Sky API². Runs are plotted on a map via Mapbox³. To avoid redundancy in the story, storytellers cannot create two chapters with the same run or photo.

Yarn automatically fills out as much data as possible. In race stories, runs, date, distance, time, and weather are filled from Strava and Dark Sky metadata. In DIY projects, the date field is set from photo or video metadata.

Formative interviewees expressed interest in sharing single moments and their full story. With Yarn, a person can share their entire story via a URL (Figure 4), which shows the story via a timeline view similar to a person’s own view of the story. A person can mark a moment as private if they do not want it to appear in this public feed. Many personal tracking apps automatically share moments as they are logged, though people often find this results in uninteresting content [13]. In Yarn, a person can instead share the data associated with a single moment by clicking the icon of a sharing platform (e.g., Twitter, SMS). Yarn then opens a dialog in the sharing platform, including the templated visual data, description data, and a link to the full story. A person can edit the text as they see fit for the platform.

Formative interview participants had varied preferences for platforms on which they might be interested in sharing their stories. We included the four platforms mentioned most by participants: Facebook, Twitter, Instagram, and SMS. Interview participants were also interested in sharing chapters with Snapchat, but no official API currently exists.

Visual Templates and Description Suggestions

Inspired by how running apps annotate photos and routes with information about distance and pace, we explored

¹ <https://strava.github.io/api/>

² <https://darksky.net/dev>

³ <https://www.mapbox.com/api-documentation/>

different methods for annotating Yarn’s visual data with the numeric data. Each annotation, or *visual template*, connects the logged data to a sharing goal. Visual templates also surface how the full story is progressing by presenting the total numeric data (bottom-right of each template, e.g. “*Total hours worked: 5.0*”) and how many chapters have been created (top-right, e.g. “*Springfield half marathon: chapter 6*”).

We created seven templates inspired by prior work on people’s sharing motivations (Figure 3). They emphasize:

- **A question** for when the goal is *information or advice*.
- **A hard time** making progress, also for moments where *emotional support* might be desired.
- **I’m back!** Describes how the accomplishment intersects with people’s everyday lives by pointing out the time since the last chapter. This template was designed for moments where storytellers might desire *emotional support*.
- **Today’s effort**, designed to align with a desire to *share an achievement* by highlighting the progress which was made.
- **My journey**, summarizing all the chapters so far to support a desire to *share an achievement* of how much progress has been made. The template is divided into squares of visual data from each chapter. Stock images relating to the accomplishment make up the remaining squares.
- **A long run** relative to other runs logged, designed to align with a desire to *share an achievement*. We included this template for race training stories only. In the formative interviews, participants wanted a design to reflect when they ran a personal best. We felt the DIY parallel (e.g., a personal minimum or maximum amount of time spent) was not a good measure of progress for most people.
- **Nothing special** when someone did not have anything they specifically wished to highlight. This template was not designed to align with a particular goal. Instead, we designed this template to allow people to create chapters they wanted to record, but felt were minor contributions to the overall story of accomplishment.

We designed Yarn to support or promote certain templates based on the data entered in a chapter. For example, the **long**

run template was only visible when the distance logged was one of the three longest runs. **My journey** was only included as a template option after two chapters had been created. In other cases, Yarn promoted certain templates by defaulting to them. For example, Yarn defaulted to the **I'm back!** template if it had been more than three days since the previous chapter was logged. **A question, a hard time, and nothing special** were always template options as was **today's effort** when numeric data was included in the chapter.

Hint text for chapter descriptions contained a few suggestions for what could be written (Figure 2). These were designed to prompt the storyteller to consider what they might want to share about that moment. For example, we included suggestions on asking for *information or advice* (e.g., “What do you need advice on?”), *emotional support* (e.g., “How can others support you?”), and *achievements* (e.g., “What are you proud of today?”). Yarn randomly picks three suggestions out of thirteen we wrote to highlight different sharing motivations.

Sizing Moments According to Importance

The chronological feed of chapters (Figure 4) is the storyteller’s primarily method for viewing their story and is the view others see in the public link. When sharing their story, interviewees wanted all chapters to be visible to demonstrate the effort put into the accomplishment, but hoped the important moments would be emphasized. Yarn uses heuristics to infer how important a chapter might be, sizing chapters as small, medium, or large in Yarn’s feed based on those heuristics. The heuristics rely only on the data logged in the chapter and the chapters which came before it chronologically, and storytellers could re-size chapters as desired. We considered updating a chapter’s importance using whether a chapter was shared online or comparing the numerical data to chapters added later, but decided people might find it unusual if chapters were resized when they revisited the app days or weeks later.

In decreasing order of weight given, Yarn uses the following to evaluate importance of a chapter:

- The amount of primary numeric data relative to other chapters (e.g., how many hours worked or miles run).
- The amount of visual data relative to other chapters (e.g., how many photos or videos were added).
- Whether the visual template had been selected before, with no weight given for the **nothing special** template.
- The length of description data relative to other chapters.

This feature intended to encode how our formative interview participants described what makes a chapter important to them. In our field study, we qualitatively assess how participants felt about the sizing of chapters. We leave it to future work to design and rigorously evaluate an algorithm for aligning sizing of chapters with perceptions of importance.

Visualize Story Progress and Social Feedback

Interview participants hoped a storytelling system would help them understand and document their accomplishment,

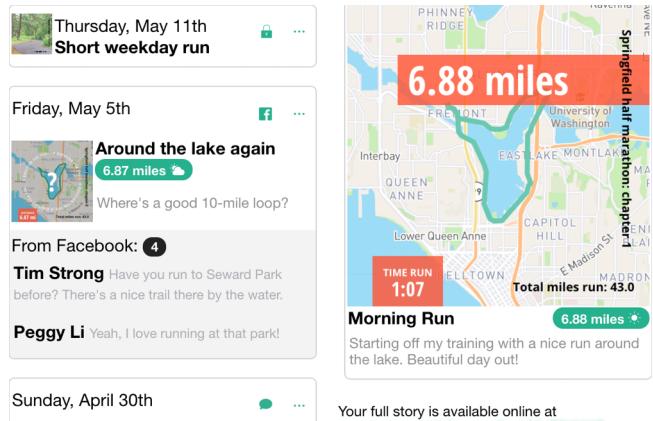


Figure 4. Yarn sizes chapters in a feed based on the numeric and visual data, template selected, and description length. Yarn supports sharing chapters to popular social channels, replicating Facebook comments and reactions in the feed. Content shown is illustrative.

in addition to sharing. In addition to Yarn’s main feed (Figure 4), we included a graph for storytellers with date on the X-axis and the cumulative primary numeric data on the Y-axis (e.g., hours worked, miles ran). This graph enables storytellers to monitor how their story is progressing.

Yarn also helps people document when and how they told their story by recording when the storyteller shares via SMS, Twitter, Facebook, or Instagram. We designed this to serve as a memory aid for social discussion. Towards this end, the timeline in Yarn also presents reactions and comments a Facebook post receives (Figure 4). We included this to explore the concept of presenting social response in a storytelling feed. Future work could explore the appropriateness and usefulness of presenting social data from different channels. For example, we suspect SMS responses would help storytellers remember what advice others had, but many people would feel their privacy was invaded if they appeared in a public story feed.

FIELD STUDY OF YARN

To understand how Yarn’s design helped people in tracking and telling their accomplishment stories, we conducted a field study where participants used Yarn for four weeks to tell their own race training or DIY stories.

To be eligible for the study, participants needed to be training for a running race or working on a DIY project. In summer 2017, we recruited a convenience sample of 10 participants via mailing lists and fliers in a mid-sized technology company. There was no overlap between participants in our formative interviews and our field study. 4 participants were working on DIY projects, 6 were training for running races. One participant ($F8^{diy}$) was working on a DIY project, but began using Yarn to record her runs as well (though she was not training for a race). $F1^{diy}$ was working on multiple home remodeling projects simultaneously, and created different stories for each. An additional participant (male, DIY project) dropped out of the study prior to creating any chapters. We do not report further on this participant.

ID	Planned Achievement(s)	How Far Through Story	Stories/ Chapters Written
F1 ^{diy} (F, 27)	Remodeling bathroom, laundry room, kitchen	Near end, Beginning	4/12
F2 ^{diy} (F, 30)	Making a quilt	Midway	1/7
F3 ^{run} (F, 28)	Half-marathon	Beginning	1/6
F4 ^{diy} (M, 43)	Upgrading mill, building a kinetic sculpture	Midway	2/4
F5 ^{run} (F, 40)	10K	Beginning	1/10
F6 ^{run} (M, 22)	5K	Midway	1/6
F7 ^{run} (F, 24)	10K	Beginning	1/5
F8 ^{diy} (F, 35)	Designing and building an inspiration wall	Beginning	2/4
F9 ^{run} (M, 37)	Half-marathon	Midway	2/5
F10 ^{run} (F, 30)	Half-marathon	Midway	1/10

Table 2. 10 participants used Yarn for 4 weeks, authoring 1-3 chapters per week.

Participants had varied levels of experience with the accomplishment they were pursuing and in telling stories about them. F4^{diy} maintained a blog for decades dedicated to DIY projects he had undertaken, while F1^{diy}, F2^{diy}, and F8^{diy} had only done one or two prior DIY projects. All race training participants had run races before, though F5^{run} began using Strava specifically for the study. F6^{run}, F9^{run}, and F10^{run} ran races at least every couple of months. The other participants were running their first race in a year or more. 7 participants identified as female, 3 as male. Age ranged between 22 and 43 (average 32). Table 2 contains additional demographics.

Participants wrote 4-12 chapters during the study (average 7). This amount of progress and engagement is about what we expected, given that all participants were working on their accomplishment in their spare time. Similar to our formative interviewees, DIY participants wrote 68% of their chapters over the weekends. Race training participants made progress throughout the week, writing 30% of chapters over weekends.

We suspect our prototype better serves the goals of early adopters of personal tracking technology, as they are already accustomed to collecting personal data and may be interested in sharing it. Choe et al. found Quantified Selfers often work in the technology sector [4], making our convenience sample an appropriate choice for gathering opinions on the design of Yarn. That said, care must be taken in generalizing our recommendations to a more diverse audience.

We scheduled an introductory meeting with participants where we helped them install Yarn, gave a brief demo of the features, and conducted a short interview about the accomplishment they were pursuing. Participants completed a short survey each week on any bugs they encountered and what they liked or disliked about the app. A longer survey at the end of the four-week study asked how they felt about components in the design of Yarn. We also interviewed each participant about answers to their final survey. Participants were given a \$70 gift card to Amazon. Participants could use Yarn after the study ended to continue telling their story, but were not compensated for doing so. The numbers around chapters created and shared in Table 2 therefore reflect people's use of Yarn up to the submission deadline.

We told participants Yarn was designed to help tell DIY and race training stories. We did not offer recommendations for when to add chapters, encouraging them to explore the app and use it to share their story if they saw fit.

Because the experience with Yarn was designed to be similar for DIY and race training participants, we analyzed our interview and survey data together rather than contrasting the two participant groups. We quote participants with F1-10, again with a superscript for story type (e.g., F1^{diy}, F3^{run}).

Participants Who Shared Emphasized Achievements, Others Wanted to Share Later or Within Communities

We focus primarily on participant perceptions of the content they created. In the four weeks of the study, three participants shared a chapter on Facebook, two shared over SMS, and two showed Yarn to someone else in-person. A bug prevented participant Facebook friends from seeing their posts (Yarn's Facebook app was left private during the study). Our current focus was on the experience of collecting, authoring, and sharing, rather than the reactions of people with whom the content was shared. But this bug made the three participants skeptical to share again, as they did not receive any response when they shared: “since I got no reaction on Facebook, it didn't motivate me to share again” (F9^{run}).

Participants primarily shared *achievements* they reached during the study. For example, F3^{run} shared one of her runs to demonstrate that her training was going well to a friend training for the same race. She said, “it proved to her that I actually have been training, so I got a ‘good job’ from her.” Similarly, F4^{diy} was proud of progress he had made on his project. F2^{diy} was the only participant who shared for *information or advice*, in part because her DIY project (a quilt) “was kind of for him, so it made sense for me to share it with him. I also wanted to show him how I was organizing [my project] and get his feedback.” Only one participant (F2^{diy}) selected the “A hard time” template and no participant shared for *support*. Participants primarily wanted to positively spin their accomplishment stories. For example, F1^{diy} felt that “even if it has been hard, I don’t necessarily want to say that it’s been hard. I want to celebrate the accomplishments rather than focus on the difficulty of getting there.”

Participants who did not share during the study tended to feel intermediate achievements were too minor. F8^{diy} felt her project was “not done, so it’s not something to be proud of yet.” F1^{diy} agreed, stating that “I might share a before and after photo at the very end of a project, but I don’t want to ‘show off’ by showing people how much work I did or bore people with all the stages.” For F6^{run}, not every story of accomplishment warranted sharing. He runs races regularly, and the race he trained for during the study was not something he considered a serious accomplishment. He felt “if I had been training really hard for a half marathon or a marathon or something, then I probably would be a little more proud of the training I had done and I probably would be more inclined to want to share it.” Others felt they would be willing to share, but only if the accomplishment story comes up in another context. F7^{run} felt “the only time I’d tell

a story [about my training] is when someone asks me like, ‘oh wow, you ran a 10K, what was your training schedule like?’ It would be nice to share that with them.”

Similar to suggestions from prior work, participants felt they would have liked to have a community with other people using Yarn to tell similar stories [13,40]. All four participants telling DIY stories expressed this sentiment, suggesting features such as making visible what other DIY projects participants were working on. F8^{diy} felt “it would be great if I could have seen other people’s projects in [Yarn]... I would have liked it to feel more like an Instagram style of app where I can see other people’s projects and get also inspired and motivated by them and their projects.” She contrasted this perspective with her experience using Yarn to track her runs: “for the running... I didn’t find it as useful. The already existing apps like Strava had the features that I was looking for.” Race training participants agreed, such as F7^{run} who was “fine sharing it in the Strava app” and was not interested in sharing through a Yarn community. That said, F3^{run}, F6^{run}, and F9^{run} felt Strava could benefit from including Yarn-like features, such as the ability to signify that a run is part of training for a race. F6^{run} wished that “in Strava you could create a goal or a story... so you could keep track of these milestones or keep track of these chapters... once you’ve completed your goal you can look back at what you’ve done and it would be easy to visualize.” F9^{run} felt “even if [other people] are training for different races, you can discover a race you didn’t know before. Even if the race is different you may train for the same distance, you could compare their training or you could see in which places they train.”

Templates Should be More Customizable, More Specific

On average, participants selected 3 templates during the study (min 1, max 5). Participants overwhelmingly picked the “today’s effort” and “nothing special” templates (39% and 32% of templates selected). Some participants, like F7^{run}, felt these two templates depicted everything they wanted to collect and share: “I pretty much only stuck to the standard [today’s effort] template, it just had everything I needed... [adding chapters] wasn’t really a creative exercise for me.” For other participants, the choice was motivated by aesthetics. F4^{diy} said, “the templates are killing me. I really want one that doesn’t touch my image content at all.” F1^{diy} agreed, “often when I need to ask a question, there is also an image that communicates [my question] ... I wouldn’t want to put so much text on top of the image because I want people to study the image to tell me an answer.”

Participants wanted the visuals and text in templates to be more customizable, both in each chapter and thematically across a story. F9^{run} felt templates should be visually distinct: “they all look very similar... there were 4-5 templates with kind of the same color. It would been good to have more choice with more diversity” (F6^{run} and F7^{run} agreed). F1^{diy}, F5^{run}, F7^{run}, and F10^{run} all described Snapchat-like features that would make their story feel more personal, including overlaying emoji or their own text. F10^{run} felt the template choices constrained her ability to be creative: “if I follow the

template exactly then it’s not my words... versus how I actually felt that day.” She went on to say, “I think if someone was a heavy user of the app, then it could get boring after a while if they were limited to just a handful of templates.”

Participants wished templates were more specific to their accomplishment, question, or struggle. For example, when F1^{diy} wanted to celebrate the achievement of her new bathtub arriving, she wished the template had reflected that excitement. She describes how she would have liked the moment presented: “I tend to be more on the minimalist side, so I might just have the text displayed more beautifully to say ‘my bathtub arrived!’. I have some friends who are really into emojis and might cover half the picture with emojis and smiley faces.” Race training participants also imagined a template could highlight more specific accomplishments, such as “if it was a PR” (F5^{run}) or what kind of run it was “if I were trying to do a distance run, say ‘distance run’, or like a ‘short run’, or some of them are like, ‘hill training’” (F3^{run}). F6^{run} felt “if a run was hard, I might want [the template] to say something more specific about it.”

Overall, participants were split on whether visual templates should reflect the sharing motivation, or whether this exposition should be left to description text. F2^{diy} suggested that a design could prompt people to select a template prior to writing the description. She said, “selecting at the end kind of made me rethink what I had written earlier. I thought it would be better beforehand so I could kind of frame what I was writing with the template in mind.”

Yarn Helped Participants Stay on Track

Four participants (F1^{diy}, F2^{diy}, F8^{diy}, and F3^{run}) brought up that using Yarn motivated them to work toward their goals. F8^{diy} felt Yarn “makes me more motivated to work on the project... I need to make SOME progress in order to [add] a new picture [to Yarn].” Though F10^{run} did not mention Yarn motivating her toward training, she mentioned “it kind of motivated me to do different trails, since I’m taking photos and stuff it made me want to venture out to different areas.”

Though we suspect increased motivation is partially a consequence of being in a study, participants felt seeing their story summarized in a visual feed and graph contributed to wanting to make progress. When F2^{diy} had started DIY projects in the past, she struggled to follow through on them. With Yarn, she described a more encouraging experience: “I would look at the graph and see how much progress I had made. Then I would go and look back at, like, ‘what did I actually do?’ and some of that was because I was filling out the [survey] form. But I think some of it too was that I like to go back and review my memories, and it was great to have that recorded somewhere... ‘oh, I’m really making progress, I’m not just spinning my wheels’. Which is kind of the issue I have with motivation with some of my [past] projects, so that was really motivating.”

DISCUSSION

Yarn’s visual feed of chapters and its graph of progress helped participants stay motivated and held them

accountable. Though participants desired more specific and flexible templates, the guided authoring experience helped them express and meet their sharing goals. Overall, we feel the content created with Yarn surpassed the baseline of how existing apps enable people to share their personal data. Though some participants did not share their story, they brought up timing, customizability, and audience as their main barriers. This is a contrast to prior explorations, where participants and interviewees described choosing not to share because they worried others would find the content they share boring and ignore it [10,13,38,40].

To extend a Yarn-like design to other stories of accomplishment, a designer would need to identify what constitutes progress toward that accomplishment, how to present that progress, and who would be interested in hearing about progress. As participants suggested, Yarn may not need to be a standalone app. Rather, features could be added to personal tracking apps (e.g., Strava, Mint) or in social networking platforms (e.g., Facebook, Instagram, or Snapchat).

Selecting Measures of Progress: People have varied preferences for what is interesting or informative in personal data [11]. Participants similarly had varied preferences for how they wanted to measure progress toward accomplishments. F2^{diy} felt monitoring the hours she spent helped keep track of her progress, while F1^{diy} and F8^{diy} preferred to think more holistically about their projects (e.g., “did I just start?”, “is there a lot left to do?”). Race training participants also preferred varied measures of progress, including distance (F3^{run}, F7^{run}, F10^{run}), pace (F6^{run}, F9^{run}), and whether they ran at all (F5^{run}). A more flexible self-tracking system (e.g., [25]) could help people track a personally meaningful indicator of progress and present it appropriate visual templates.

Participants felt intermediate achievements, like a personal best run or a major step toward their project, were too minor to share. In spite of this, they also valued how those moments contributed to their overall stories. Designs could better help people clarify what was noteworthy in these achievements, which in turn might encourage people to share and celebrate these moments. For example, visual templates could give people the freedom to describe accomplishments in their own words as a banner or sticker (as F1^{diy} suggested).

Presenting Progress: In designing Yarn, we sought to create a guided yet flexible authoring experience. Our results indicate we succeeded at creating a guided experience, but participants would have valued even more flexibility and customization. We suggest future designs treat visual templates as more “template-like”, with a good default and customization on demand. For example, F5^{run} said, “*some of them already had a phrase, like ‘the hardest run’... maybe I don’t like that phrase, but I might have liked that template... maybe you [can] have the same version without creating that mood so strongly... if it’s easy to add to it, I like to customize everything.*” Each template aligning with a sharing goal, such as a desire for support, could offer phrases or layouts expressing the sentiment and allow people to choose their

favorite. As F5^{run} suggested, templates could express different levels of accomplishment (e.g., a minor achievement, a major milestone). They could also be left blank, leaving it up to the storyteller to write a phrase directly on the visual template.

Finding an Interested Audience: Prior work has suggested that broad social networking sites like Facebook or Twitter might not be an appropriate place for sharing personal tracked data [13,38,39]. Different sharing motivations lend themselves to different audiences [40]. Field study participants were comfortable sharing achievements via SMS and on Facebook, but never shared for support or advice. We suspect people would be more inclined to share for those motivations in a community of other people working toward similar accomplishments. A community may be more willing to offer support and more able to offer advice because they understand the challenges and steps required to complete the accomplishment. We expect people would still want to share achievements to their close ties regardless of whether they have completed a similar story. A future design could support sharing all moments, including questions and requests for support, to a community, while suggesting intermediate achievements be shared via other channels. Much like in Yarn, interested people could follow a link to view the whole story.

Though some participants did share their progress during the study, others indicated they were interested in sharing if the accomplishment they were pursuing came up socially or when they were closer to completing the accomplishment. Others expressed no interest in telling their stories at all, instead preferring to journal for later reference or motivation. Rather than assume people know how they intend to share a moment when it occurs, future designs can support people in telling their stories more opportunistically. For example, a design could automatically create a video which highlights the key visual data and cumulative numerical progress. Designs could also help people filter their story when a sharing opportunity aligns with a motivation, such as surfacing all questions if someone meets an expert on DIY projects.

CONCLUSION

We contribute design principles for telling stories of accomplishment through personal data, specifically a guided authoring process to help people align the content they create with their motivations for sharing. Our mobile app, Yarn, demonstrates these design principles by prompting people to explain their reason for sharing in a description and by offering visual templates which emphasize different sharing motivations. Yarn helped field study participants create content they wanted to share with friends and family as well as dedicated online communities. Future designs should balance tensions between flexible content versus easy authoring, as well as the content needs of dedicated communities versus broader social networking platforms.

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REFERENCES

1. Mark Blythe. (2017). Research Fiction: Storytelling, Plot and Design. *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI 2017)*, 5400–5411. <http://doi.org/ccv8>
2. Christopher Booker. (2006). *The Seven Basic Plots: Why We Tell Stories*. Bloomsbury Academic.
3. Pei-Yu (Peggy) Chi and Henry Lieberman. (2011). Intelligent Assistance for Conversational Storytelling Using Story Patterns. *Proceedings of the International Conference on Intelligent User Interfaces (IUI 2011)*, 217–226. <http://doi.org/dhmrv6>
4. Eun Kyoung Choe, Nicole B. Lee, Bongshin Lee, Wanda Pratt, and Julie A. Kientz. (2014). Understanding Quantified-Selfers' Practices in Collecting and Exploring Personal Data. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2014)*, 1143–1152. <http://doi.org/bbpd>
5. Munmun De Choudhury, Mrinal Kumar, and Ingmar Weber. (2017). Computational Approaches Toward Integrating Quantified Self Sensing and Social Media. *Proceedings of the ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW 2017)*, 1334–1349. <http://doi.org/cc6v>
6. Chia-Fang Chung, Elena Agapie, Jessica Schroeder, Sonali Mishra, James Fogarty, and Sean A. Munson. (2017). When Personal Tracking Becomes Social: Examining the Use of Instagram for Healthy Eating. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2017)*, 1674–1687. <http://doi.org/ccq4>
7. Sunny Consolvo, Katherine Everitt, Ian Smith, and James A. Landay. (2006). Design Requirements for Technologies that Encourage Physical Activity. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2006)*, 457–466. <http://doi.org/b2wmz3>
8. Justin Cranshaw, Andrés Monroy-Hernández, and S.A. Needham. (2016). Journeys and Notes: Designing Social Computing for Non-Places. *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*, 4722–4733. <http://doi.org/cc65>
9. Franco Curmi, Maria Angela Ferrario, Jen Southern, and Jon Whittle. (2013). HeartLink: Open Broadcast of Live Biometric Data to Social Networks. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2013)*, 1749–1758. <http://doi.org/bjh7>
10. Daniel A. Epstein, Alan Borning, and James Fogarty. (2013). Fine-Grained Sharing of Sensed Physical Activity: A Value Sensitive Approach. *Proceedings of the ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp 2013)*, 489–498. <http://doi.org/bdsq>
11. Daniel A. Epstein, Felicia Cordeiro, Elizabeth Bales, James Fogarty, and Sean A. Munson. (2014). Taming Data Complexity in Lifelogs: Exploring Visual Cuts of Personal Informatics Data. *Proceedings of the ACM Conference on Designing Interactive Systems (DIS 2014)*, 667–676. <http://doi.org/bbng>
12. Daniel A. Epstein, Felicia Cordeiro, James Fogarty, Gary Hsieh, and Sean A. Munson. (2016). Crumbs: Lightweight Daily Food Challenges to Promote Engagement and Mindfulness. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2016)*, 5632–5644. <http://doi.org/bjh8>
13. Daniel A. Epstein, Bradley H. Jacobson, Elizabeth Bales, David W. McDonald, and Sean A. Munson. (2015). From “nobody cares” to “way to go”! A Design Framework for Social Sharing in Personal Informatics. *Proceedings of the ACM Conference on Computer Supported Collaborative Work (CSCW 2015)*, 1622–1636. <http://doi.org/bbks>
14. Daniel A. Epstein, An Ping, James Fogarty, and Sean A. Munson. (2015). A Lived Informatics Model of Personal Informatics. *Proceedings of the ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp 2015)*, 731–742. <http://doi.org/bdsr>
15. Deborah Estrin. (2014). Small data, where n = me. *Communications of the ACM*, 57(4), 32–34. <http://doi.org/cc6w>
16. Jim Gemmell, Aleks Aris, and Roger Lueder. (2005). Telling Stories with MyLifeBits. *Proceedings of the IEEE International Conference on Multimedia and Expo (ICME 2005)*, 1536–1539. <http://doi.org/cm75c9>
17. Jim Gemmell, Gordon Bell, and Roger Lueder. (2006). MyLifeBits: A Personal Database for Everything. *Communications of the ACM*, 49(1), 88–95. <http://doi.org/dqs5z6>
18. Shion Guha and Jeremy Birnholtz. (2013). Can You See Me Now? Location, Visibility and the Management of Impressions on foursquare. *Proceedings of the International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI 2013)*, 183–192. <http://doi.org/ccwb>
19. Xinning Gui, Yu Chen, Clara Caldeira, Dan Xiao, and Yunan Chen. (2017). When Fitness Meets Social Networks: Investigating Fitness Tracking and Social Practices on WeRun. *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI 2017)*, 1647–1659. <http://doi.org/ccwc>
20. Cheng-kang Hsieh, Longqi Yang, Honghao Wei, Mor Naaman, and Deborah Estrin. (2016). Immersive Recommendation: News and Event Recommendations Using Personal Digital Traces. *Proceedings of the International Conference on World Wide Web (WWW 2016)*, 51–62. <http://doi.org/cc6x>

21. Kevin O. Hwang, Allison J. Ottenbacher, Angela P. Green, M. Roseann Cannon-Diehl, Oneka Richardson, Elmer V. Bernstam, and Eric J. Thomas. (2010). Social Support in an Internet Weight Loss Community. *International Journal of Medical Informatics*, 79(1), 5–13. <http://doi.org/dtbr7m>
22. Elisabeth T. Kersten-van Dijk and Wijnand A. IJsselsteijn. (2016). Design Beyond the Numbers: Sharing, Comparing, Storytelling and the Need for a Quantified Us. *Interaction Design and Architecture(s) Journal (IxD&A)*, (29), 121–135.
23. Joy Kim, Maneesh Agrawala, and Michael S. Bernstein. (2017). Mosaic: Designing Online Creative Communities for Sharing Works-in-Progress. *Proceedings of the ACM Conference on Computer-Supported Cooperative Work and Social Computing (CSCW 2017)*. <http://doi.org/ccwd>
24. Joy Kim, Mira Dontcheva, Wilmot Li, Michael S. Bernstein, and Daniela Steinsapir. (2015). Motif: Supporting Novice Creativity through Expert Patterns. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2015)*, 1211–1220. <http://doi.org/bjjf>
25. Young-Ho Kim, Jae Ho Jeon, Bongshin Lee, Eun Kyoung Choe, and Jinwook Seo. (2017). OmniTrack: A Flexible Self-Tracking Approach Leveraging Semi-Automated Tracking. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT)*, 1(3). <http://doi.org/cc6z>
26. Brian M. Landry and Mark Guzdial. (2006). iTell: Supporting Retrospective Storytelling with Digital Photos. *Proceedings of the Conference on Designing Interactive Systems (DIS 2006)*, 160–168. <http://doi.org/fm5n9x>
27. Ian Li, Anind Dey, and Jodi Forlizzi. (2010). A Stage-Based Model of Personal Informatics Systems. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2010)*, 557–566. <http://doi.org/bh8zs8>
28. Ian Li, Anind K. Dey, and Jodi Forlizzi. (2011). Understanding My Data, Myself: Supporting Self-Reflection with Ubicomp Technologies. *Proceedings of the International Conference on Ubiquitous Computing (UbiComp 2011)*, 405–414. <http://doi.org/cnsw9k>
29. James J. Lin, Lena Mamykina, Silvia Lindtner, Gregory Delajoux, and Henry B. Strub. (2006). Fish'n'Steps: Encouraging Physical Activity with an Interactive Computer Game. *Proceedings of the International Conference on Ubiquitous Computing (UbiComp 2006)*, 261–278. <http://doi.org/crcvd9>
30. Fannie Liu, Laura Dabbish, and Geoff Kauffman. (2017). Supporting Social Interactions with an Expressive Heart Rate Sharing Application. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT)*, 1(3). <http://doi.org/cc62>
31. Diane Maloney-Krichmar and Jenny Preece. (2005). A Multilevel Analysis of Sociability, Usability, and Community Dynamics in an Online Health Community. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 12(2), 201–232. <http://doi.org/fm3r9t>
32. Hilary McLellan. (2006). Corporate Storytelling Perspectives. *Journal for Quality and Participation*, 29(1), 17.
33. Sarah McRoberts, Haiwei Ma, Andrew Hall, and Svetlana Yarosh. (2017). Share First, Save Later: Performance of Self through Snapchat Stories. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2017)*. <http://doi.org/ccwf>
34. Andrew D. Miller and W. Keith Edwards. (2007). Give and Take: A Study of Consumer Photo-Sharing Culture and Practice. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2007)*, 347–356. <http://doi.org/d773qc>
35. Meredith Ringel Morris, Jaime Teevan, and Katrina Panovich. (2010). What Do People Ask Their Social Networks, and Why? A Survey Study of Status Message Q&A Behavior. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2010)*, 1739–1748. <http://doi.org/c69>
36. Tim Moynihan. (2016). Google Photos Now Builds Perfect Vacation Albums on its Own. *Wired*. <https://www.wired.com/2016/03/google-photos-assistant/>
37. Florian Mueller, Frank Vetere, Martin R. Gibbs, Darren Edge, Stefan Agamanolis, and Jennifer G. Sheridan. (2010). Jogging over a Distance between Europe and Australia. *Proceedings of the ACM Symposium on User Interface Software and Technology (UIST 2010)*, ACM Press, 189–198. <http://doi.org/b5jmjp>
38. Sean A. Munson and Sunny Consolvo. (2012). Exploring Goal-Setting, Rewards, Self-Monitoring, and Sharing to Motivate Physical Activity. *Proceedings of the International Conference on Pervasive Computing Technologies for Healthcare (PervasiveHealth 2012)*, 25–32. <http://doi.org/bbn8>

39. Sean A. Munson, Erin Krupka, Caroline Richardson, and Paul Resnick. (2015). Effects of Public Commitments and Accountability in a Technology-Supported Physical Activity Intervention. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2015)*, 1135–1144. <http://doi.org/bbkw>
40. Mark W. Newman, Debra Lauterbach, Sean A. Munson, Paul Resnick, and Margaret E. Morris. (2011). “It’s not that I don’t have problems, I’m just not putting them on Facebook”: Challenges and Opportunities in Using Online Social Networks for Health. *Proceedings of the ACM Conference on Computer Supported Cooperative Work (CSCW 2011)*, 341–350. <http://doi.org/bcvgg7>
41. Oded Nov, Mor Naaman, and Chen Ye. (2009). Motivational , Structural and Tenure Factors that Impact Online Community Photo Sharing. *Proceedings of the International Conference on Weblogs and Social Media (ICWSM 2009)*, 138–145. <https://www.aaai.org/ocs/index.php/ICWSM/09/paper/viewPaper/206>
42. Lora Oehlberg, Wesley Willett, and Wendy E. Mackay. (2015). Patterns of Physical Design Remixing in Online Maker Communities. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2015)*, 639–648. <http://doi.org/ccwg>
43. John Rooksby, Mattias Rost, Alistair Morrison, and Matthew Chalmers. (2014). Personal Tracking as Lived Informatics. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2014)*, 1163–1172. <http://doi.org/bbdz>
44. Daniela K. Rosner and Jonathan Bean. (2009). Learning from IKEA Hacking: “I’m Not One to Decoupage a Tabletop and Call It a Day.” *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2009)*, 419–422. <http://doi.org/bgn58m>
45. Daniela K. Rosner and Kimiko Ryokai. (2008). Spyn : Augmenting Knitting to Support Storytelling and Reflection. *Proceedings of the International Conference on Ubiquitous Computing (UbiComp 2008)*, 340–349. <http://doi.org/b5hrb5>
46. Edward Yu-Te Shen, Henry Lieberman, and Glorianna Davenport. (2009). What’s Next?: Emergent Storytelling from Video Collections. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2009)*, 809–818. <http://doi.org/cnwv6h>
47. Meredith M. Skeels, Kenton T. Unruh, Christopher Powell, and Wanda Pratt. (2010). Catalyzing Social Support for Breast Cancer Patients. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2010)*, 173–182. <http://doi.org/cnxsm9>
48. Manya Sleeper, William Melicher, Hana Habib, Lujo Bauer, Lorrie Faith Cranor, and Michelle L. Mazurek. (2016). Sharing Personal Content Online: Exploring Channel Choice and Multi-Channel Behaviors. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2016)*, 101–112. <http://doi.org/bwgf>
49. Rannie Teodoro and Mor Naaman. (2013). Fitter with Twitter : Understanding Personal Health and Fitness Activity in Social Media. *Proceedings of the International AAAI Conference on Weblogs and Social Media (ICWSM 2013)*, 611–620. <http://sm.rutgers.edu/pubs/Teodoro-FitterTwitter-ICWSM2013.pdf>
50. Janet Vertesi, Jofish Kaye, Samantha N. Jarosewski, Vera D. Khovanskaya, and Jenna Song. (2016). Data Narratives: Uncovering Tensions in Personal Data Management. *Proceedings of the ACM Conference on Computer-Supported Cooperative Work & Social Computing (CSCW 2016)*, 477–489. <http://doi.org/bwgg>
51. Jason Wiese, Sauvik Das, Jason I. Hong, and John Zimmerman. (2017). Evolving the Ecosystem of Personal Behavioral Data. *Human-Computer Interaction*, 1–64. <http://doi.org/ccwh>
52. Jason Wiese, Patrick Gage Kelley, Lorrie Faith Cranor, Laura Dabbish, Jason I. Hong, and John Zimmerman. (2011). Are You Close with Me? Are You Nearby?: Investigating Social Groups, Closeness, and Willingness to Share. *Proceedings of the International Conference on Ubiquitous Computing (UbiComp 2011)*, 197–206. <http://doi.org/cqcphr>
53. Xuan Zhao, Cliff Lampe, and Nicole B. Ellison. (2016). The Social Media Ecology: User Perceptions, Strategies and Challenges. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2016)*, 1–12. <http://doi.org/cc64>
54. Xuan Zhao, Niloufar Salehi, Sasha Naranjit, Sara Alwaalan, Stephen Voida, and Dan Cosley. (2013). The Many Faces of Facebook : Experiencing Social Media as Performance, Exhibition, and Personal Archive. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2013)*, 1–10. <http://doi.org/bjjp>