Pintail: A Travel Companion for Guided Storytelling

by

Sujoy Kumar Chowdhury

Submitted to the Program in Media Arts and Sciences,

School of Architecture and Planning,

In partial fulfilment of the requirements for the degree of

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May 18, 2018

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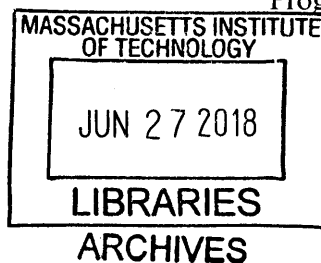Christopher Schmandt
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Abstract

Pintail is a mobile companion application for guided storytelling. To inspire and augment story creation, Pintail uses priming as a technique by showing the user what others feel or have drawn about the places s/he is visiting. These Pintail prompts are synthesized from online travel reviews and doodle books. Some prompts are displayed in an ambient manner on a second screen. Users can use the Pintail story-creation tools to remix, reflect and create their own stories. The stories created by Pintail have an analog form. They are printed on a re-purposed mobile receipt printer. They are designed to catalyze in person-conversations. Pintail tries to balance between the story creation activity and the actual travel experience. Pintail provides the users with the structure and tools for storytelling that are aware of the short attention span of today's audience.

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Finally, I remember my dad, Ashish Kumar Chowdhury, who is always in my mind, but could not be here in person today to see that I finally completed this thesis.

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Chapter 1: Introduction

Travellers today spend a significant amount of time engaging with technology while they are traveling. 64% of American travellers get inspiration for their destinations from social media and other online sources ("The State of the American Traveler Study," 2018). Travellers are often in conscious or unconscious pursuit of storytelling. They have powerful computers in their pockets that make it easy to access information and capture visual media. But they are using mobile computing more for consumption of content, and less for creation. That leaves their storytelling pursuit under-served, while the computing power remains under-utilized. Technology is not augmenting human storytelling to the extent it can.

1.1 CONCEPT
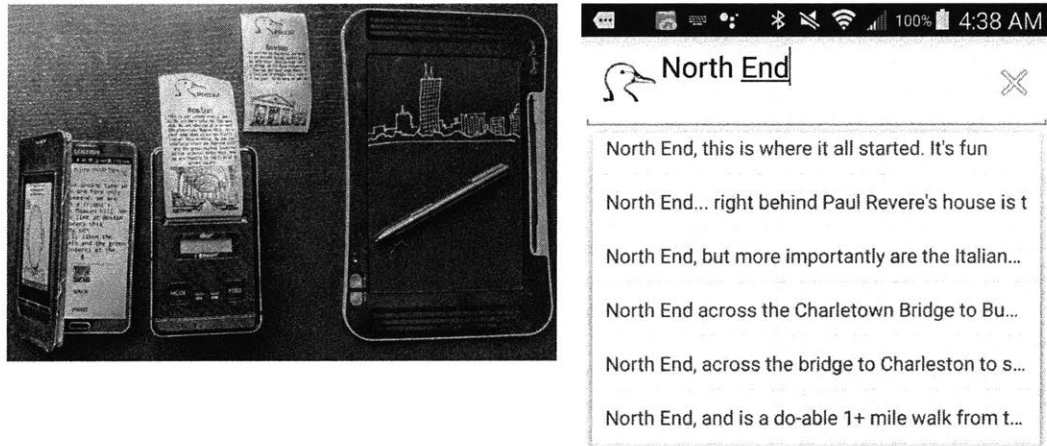
Figure 1-1. Pintail system at a glance

The topic of current thesis is Pintail. Pintail is a travel companion app that augments the innate human pursuit of storytelling. Pintail synthesizes story prompts from existing reviews and context, provides form and functions for creating stories that increase the potential of meaningful conversations with audience. Pintail app (called Pintailgram) resides in four connected devices: a mobile phone, a mobile printer, a mobile 'second screen' and an electronic doodling tablet.

1.2 DEFINITION AND SCOPE

It is important to constrain the operational definitions and scope of key terms used in this thesis in order to establish the guardrails on scope. The overloaded use of those terms otherwise risk meaning different things to the reader.

Stories: This thesis examines non-fiction travel stories only. A Pintail story is an artefact that has ideally one picture, and a few contextual sentences. The picture can be a photograph or a digital doodle. A Pintail story has a quirky analog form. It is printed using a repurposed off-the-shelf mobile receipt printer and printed on receipt paper. The stories can only be consumed by reading atomic Pintail stories or 'Pintailgrams' from printed receipt paper.

Priming: Priming (Weingarten et al., 2016) is the process of providing a stimulus to users that influences their near-term future thoughts and actions, even though they may not seem to be connected. Pintail uses priming as a technique to prompt the users with story cues. Pintail shows the user what others feel, stated or have drawn about the places s/he is visiting. Priming is discussed in more detail in Chapter 2.

Story prompt: Story prompts are fragments of existing travel reviews that have the potential to prime or influence story creation by a traveller. Story prompts are potent enough to achieve a mere exposure effect when tacitly attended. Story prompts can change based on location or other context. Story prompts in current thesis can be either text or image based.

Storytelling: Storytelling includes triggers for storytelling, story creation and story sharing. Story creation involves content selection, writing or remixing and editing. The term 'storytelling' may be used as an umbrella term throughout this thesis to represent one of the activities above, not just sharing. Augmenting a human storytelling activity involves assisting in each of these phases, with an emphasis on priming story creation.

Travel companion: For current thesis, a travel companion is a context aware digital assistant that produces analog (paper) stories. It augments human storytelling activity by priming story prompts. It is called a companion because it has use-cases spanning across the lifecycle of travel. Ideally, a travel companion is present in all mobile and connected devices travellers carry.

Pintail: Pintail is the name of the travel companion in this thesis. It is implemented as an app experience connecting multiple off-the-shelf mobile and connected devices. The connected set of devices where Pintail resides includes a mobile phone, an e-ink based 'second screen' attached to the cover of the mobile phone, a mobile receipt printer and an LCD based electronic doodling tablet.

Table 1-1: Pintail travel companion experience at a glance

Name	What it does	UI	Device
Pintail phone app	Android app that has primary UI for Pintail. Generates prompts from travel reviews based on location or user input. Hub of background services to fetch input or send output to other devices.	Interactive UI	Android phone (Samsung Note 3)
Pintail printer	Prints Pintail stories or Pintailgrams	No UI, output only device	Mobile receipt printer (STAR SM-s220i)
Pintailgram	An atomic analog Pintail story	Paper output of Pintail printer	Receipt paper
Pintail Screen	A 'second screen' for Pintail's location based doodle prompts	Non-interactive UI	E-ink based InkCase Plus screen and FitCase case for Android devices
Pintail Slate	Electronic doodling surface for location based doodles	Electronic Sketch-and-erase like input device	LCD based standalone tablet with stylus (Boogie Board Sync)

Travel reviews for prompts: Pintail derives text based story prompts from online travel reviews. One important premise of this thesis is that contextual travel reviews can be used as a proxy for existing travel stories. Pintail also sources image or doodle prompts from location specific printed travel guides or books.

Second screen for prompts: A second screen traditionally involves the use of a computing device like phone or tablet to provide an enhanced viewing experience for content on another device, such as a television. In case of Pintail, the phone itself has an e-ink based 'second screen' attached in the phone cover. Pintail provides story prompts in two ways. When the traveller has expressed a storytelling intent by clicking on the phone app, interactive pull based prompts are visible that augment

traveller's story creation activity. In other cases, location based story prompts are pushed non-interactively to the 'second screen' in order to induce a priming effect.

Slow technology for prompts: Slow technology (Hallnäs & Redström, 2001) is technology that aims at reflection and moments of mental rest rather than efficiency in performance. Pintail is a slow technology and a calm companion to a great extent. It does not bombard the traveller with notifications. It chooses to remain ambient in a second screen and leaves room for reflection. When the user picks up the phone and engages with the app, only then the full-fledged companion experience is unfolded.

Remixing for story creation: Remixing or combinatorial creativity is the concept of creating new content based on combining and acting upon other content. Pintail provides fragments of travel reviews based on context. Users are then encouraged to remix or make new stories out of them.

Analog stories as conversation starters and self-limiting stories: Pintail outputs its stories in analog form (paper). Because of novelty, they are conversation starters form the get go. Also, by design, paper based stories impose a limit on how much can be produced and shared. Pintail is thus a self-limiting technology the similar way a search engine or a dating app is (S. Kamvar, 2012). Its use does not lead to more use.

1.3 A TRAVEL COMPANION FOR STORYTELLING

With the meteoric rise of photography in the visual culture over the past century and a half, photographic images have become an indispensable element of chronicling travel experience. Sontag studied the force of photographic images as they are continually inserted between experience and reality (Sontag, 1973). She noted the heightened use of photography in tourism to validate experience: "It seems positively unnatural to travel for pleasure without taking a camera along. Photographs will offer indisputable evidence that the trip was made, that the program was carried out, that fun was had."

Advent of new technologies like photography and mobile devices and their mass adoption function as "relationship enablers" (Konijn, Utz, Tanis, & Barnes, 2008). At one end, they provide new forms of interpersonal communication. At another end, they also fundamentally change the face of interaction between the self and the other.

While mobile devices make it easy to capture or share pictures, it is still surprisingly challenging to create a coherent travel story using it. A technology gap seems to exist in that space. We are not seeing enough utilization of technology in the form of a context-aware travel companion that can guide the human pursuit of storytelling.

A travel companion can bridge that gap in a number of ways. Production of a good story is a cognitively expensive endeavour. First, one needs to produce content for the story. Stories or story related content do not germinate from vacuum. Every storytelling action can be seen as a response to a relevant stimulus. This response may come from a subconscious impulse, or an actively sought inspiration. Travel companions can play a role here. They can make the slope of creation less steep by priming with story prompts.

Simply creating content is not enough for storytelling. To become a good story, existing content needs to be augmented or articulated with context, scrubbed, and stitched together. A travel companion can assist humans in each of these stages. The final output, created by a human in collaboration with a companion, needs to have a consumable form. Travel companions have the option to use a significant amount of available technology. Ideal companions also have self-imposed design constraints so that they respect all limits of human factors, do not cause sensory overload and do not take away time from the core travel experience. They can help pick the ideal content. They can ensure that its triggers or prompts are more context-aware and unobtrusive.

Again, storytelling is already a cognitively demanding task. As cognitive misers, our brains are hardwired to take shortcuts that smartphones afford (Barr, Pennycook, Stolz, & Fugelsang, 2015). If story consumption has a shorter path than story creation, our brains shift to story consumption mode. If sharing a picture with out proper articulation of context qualifies as a story, our brains take the context-less route. Thus, the ability to generate certain kinds of content fast and easily comes with some unintended side effects. Those side effects, coupled with sensory overload of consumption, indirectly impose a tax on context-rich storytelling.

The existing iterations of technological support or augmentation for storytelling have not been the ideal ones. Some of those technologies today aspire to automate storytelling. These efforts of automation ignore the fact that storytelling is an innately humane experience. Unsuspecting users may seem to be happy to completely

outsource storytelling to technology. Social networks incentivize them to share stories they did not stitch together at all. But this automation and incentives do not help in the core pursuit of storytelling. It misses the point by lacking a human touch.

Overall, in the context of travel storytelling, technology seems to be underserving in areas like story inspiration or story prompts. Automation is not happening at the right places. The stories at the end are making human capacities overloaded and story creation slower.

1.4 PROBLEM SPACE

Before we get too excited about using any technology for storytelling, it is important to articulate the problem space of storytelling in a more structured fashion. Storytelling is a multi-step process. It includes getting inspiration for telling stories, active creation (content selection, writing, editing) and sharing. The challenges encountered in storytelling can be described in any of the following three overlapping stages:

1. *Inspiration*
2. *Story creation and*
3. *Distribution*

1.4.1 Inspiration

Let's describe our brain as an *operating system*, and the act of storytelling as a *task*. Following that, there may exist something equivalent to a *task scheduler* that loads the storytelling *task* into our brain when certain events or *triggers* happen. When that happens, we start thinking about stories and creating our stories. Regardless of why or how this happens, we care more when it does not happen per our expectation. That is when we say that we do not have enough inspiration for telling stories.

Triggers: The most frustrating bit about story triggers is that we usually do not have much control over them. Story triggers are actions or events that invoke intents for storytelling. Something changes external to our brains in the environment. We become aware of it. And suddenly we are in the mood for storytelling. The task is *running*. It feels like some catalysts have lowered the activation energy in our brain, required for the reaction of storytelling to happen (Key & Ball, 2014).
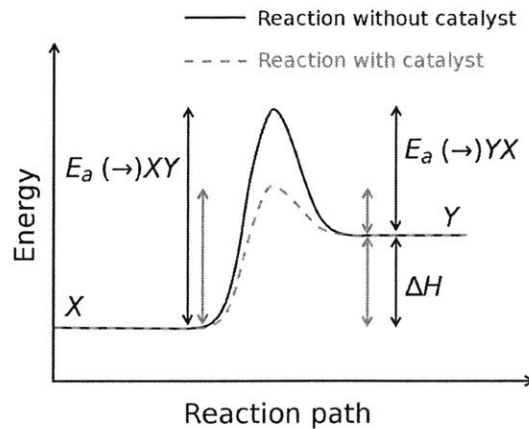
Figure 1-2. The role of story triggers is analogous to the role of catalysts in lowering the activation energy of a chemical reaction (described by Arrhenius in 1889, image from Wikipedia)

We can articulate some cases where triggers happen more frequently. It happens more often when we visit new places and become more culturally sensitive (Anderson, Lawton, Rexeisen, & Hubbard, 2006). We start to observe, hear, and experience more details in the environment. The increased physical activity, cognitive stimulation and social engagement position our brains to be more attentive and more engaged (Noel, 2014). We start to care more about what interesting things our friends, family or random people in the Internet have to say about this place. We become aware that we 'feel' something. We feel the urge to talk to someone we know, about the experience we just had. Suddenly, it does not seem odd to strike up spontaneous conversations with complete strangers who happen to be at the same place at the same time.

The problem is, those triggers are very transient. Their effect seems to weaken when we are no longer in that place. We often over-compensate for that by recording everything.

Source for triggers: Let us think of another analogy for a minute. A **teleprompter**, cuing our brains with sentences or visuals. Let us assume for the sake of argument that we construct something similar to that teleprompter to trigger storytelling. Then arises the question: what will we feed it as input? There is no *script* that our *teleprompter* technology can readily use.

That means, we need to find a reliable source for the *script* or trigger. Fortunately, we do have a number of sources where we can look at. For example: Travel reviews, social media posts, text or emails sent to friends and family etc. Of them, online travel

reviews can be a good proxy for travel stories. Travel reviews make a good choice because they have an inherent structure, are self-contained and can be scraped at scale.

The problem with travel reviews is that, there are too many and too noisy. How will the *teleprompter* know which of them to *cue* to trigger storytelling?

Contextual triggers: That brings us to context. Location is the most obvious context for a story trigger. When we visit Japan, we like to read and tell more stories about Japan, less about Russia. Travel reviews are usually organized by location, giving us some control or filter as we harvest the *script* for our *teleprompter*. But location is not the only context. We can think of other contexts that can be potent triggers. For example, how other people feel about the place, how weather or time of day or any other common topic of interest influenced their experience etc. may be deemed as contextual.

We can relate more and feel more impulse to share our version of the story when we come across another story or review with common context, with our kind of context.

A challenge for contextual triggers is to be able source a trigger based on context other than location. The same trigger also does not work for everyone.

A screen for triggers: If we are still following the *teleprompter* analogy, we should notice that a crucial piece is missing: the *screen* of the *teleprompter*. The widely used surfaces or screens in mobile form-factors routinely demand our complete attention when in use. The smart-watches are a good exception because they are glance-able. The phone screens are not always so. The real estate is premium in both cases and ideally should be reserved for primary use-cases like call, text etc. What is missing is a second screen that can be used as a surface for secondary use-cases like story inspiration.

1.4.2 Story creation

After a successful trigger, story creation begins. For Pintail's definition of stories, it is mostly a writing activity.

An interface for idea remix: It is common for story creation interfaces to start from a blank slate. Blank slates can be outperformed by interfaces that come with writing

prompts (Yackanicz, 2000). Multiple writing prompts also open the door for remixing.

Structure: Story creation tools are expected to come equipped with pre-defined structures or templates. But, providing a good frame of reference for the story can be quite challenging. Too much structure can make a story too rigid and mechanistic. Too little a structure can make it time-consuming to produce and difficult to consume.

Timing: Most story creation tools operate in a fire-and-forget (create-share-and-forget) mode. By design, those tools do not afford stories that can evolve or grow over time.

Task allocation: Story creation tools often do not allocate tasks properly between humans and computers. Automated stories are a prime example. It is not satisfying to let a bot tell our own stories because they lack our unique perspectives, emotions and subjective observations (Levy, 2012). Humans are not drawn to them naturally either because they are less readable (Graefe, Haim, Haarmann, & Brosius, 2018).

1.4.3 Distribution

Story creation is followed by distribution or sharing activity.

Over sharing: Technology can be too 'fast' and overwhelming when it comes to sharing. Social networks reinforce personality traits like narcissism (Wang & Stefanone, 2013), often to the detriment of both the storyteller and audience.

Conversation starter: Adjusting content for striking up meaningful conversations with an online or offline audience is a daunting task. The storyteller is to start from common ground, layer it with his or her unique experience, often in unique form.

This leads to the research questions and hypotheses of current thesis.

1.5 RESEARCH QUESTIONS AND HYPOTHESES

1. Is it possible to channel a story consumption activity into story creation?

   a. *Hypothesis:* **Story prompts sourced and sifted from contextual travel reviews** can achieve a **priming or mere exposure effect** for story creation.

   b. *Hypothesis:* **Remixing** fragments of contextual travel reviews can help travellers create new travel stories.

2. Is it possible to use **slow technology** as a calm travel companion to **prime,** trigger and augment articulation of human experiences?

   Hypothesis: **Travel prompts on the 'second screen'** of phone cover **can be used as a slow technology** to prime story creation.

3. Is it possible for travel companions to help create stories that are **conversation starters?**

   Hypothesis: A **Pintailgram** or a compact **travel story printed on receipt paper** can be used as a conversation starter.

4. Is it possible to use **self-limiting technology** to help travellers strike a **balance** between story creation or sharing activities and actual travel experience?

   a. *Hypothesis:* A travel companion that **limits consumption** of travel content can still inspire creation of meaningful travel stories.

   b. *Hypothesis:* Paper based travel stories with **limited sharing** options can lead to a satisfying storytelling experience.

   c. *Hypothesis:* Travel stories that address the short attention span of audience by **limiting length** can lead to a satisfying storytelling experience.

Pintail is a set of proof of concept applications in exploration of above research questions and hypotheses. A user study was conducted at the end. Because of limited number of users, this thesis did not involve empirical hypothesis testing for each variable in the research questions above. The limited field-testing did collect directional evidence towards hypotheses stated above.

1.6 TARGET AUDIENCE

According to World Bank, there were 1.45 billion outbound international tourists in 2016[1]. The target audience of Pintail is technology-literate travellers. As early adopters, they are not shy of carrying and using multiple connected mobile devices while they are on the go. They have a pursuit of storytelling. They are ready to go that extra mile to use twenty first century technology for guided and curated story telling.

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[1] http://wdi.worldbank.org/table/6.14

To them, storytelling does not end in sharing stories in online social networks. They possess a natural craving for in person conversations spawned from those stories.

1.7 SCENARIO

1.7.1 Before Pintail

John is an ideal persona representing Pintail's target user-base. Today, he is somewhat 'Alone together' (Turkle, 2011a) because he is consumed by the devices he is carrying. He loves to travel. He is passionate about telling stories about his trips. He is visiting Boston for the first time. As an early adopter of technologies, John scoured travel reviews from online and offline resources to research on a list of locations he wants to visit. He is also carrying a travel guide on Boston. He has been taking a lot of pictures since he came to Boston. John wants to write a story on his Boston experience.

But he is finding it difficult to start, even with so many pictures to choose from. He attempts to pick the top few pictures. After some time, he gets frustrated that he did not make much progress in his story. He simply posts rest of his unsorted pictures into a popular social network.

Sonia is John's friend. Sonia is usually curious about John's travel stories. She noticed that John just posted hundreds of random pictures from his Boston trip. They did not have any caption or description. Some of them were near duplicates where John was clearly trying to get the best shot of Boston skyline. She wonders why John posted all of them. This is so boring, and overwhelming! Sonia loses interest. She closes the browser window.

John feels that he has not had a meaningful conversation with anyone regarding his Boston trip. While he was interacting with locals, the conversations did not go far. When his album was posted, not many of his friends seemed to care enough to press the 'like' button. Comments were few and generic. He realizes there must be something less than interesting about his stories.

1.7.2 After Pintail

John installed Pintail app in his phone before travelling to Boston. Since he is all-in for storytelling, he is also carrying a Pintail printer and a Pintail slate device. Pintail has helped him create a number of interesting Pintailgrams.

Whenever he was looking something up in the app, John got a feed of travel review snippets by other users. Some of them triggered him to get started with his own stories.

John is a fan of his Pintail slate. He finds himself doodling a lot these days. He feels it has something to do with the location based doodle prompts in his Pintail slate.

John carries his printed Pintailgrams in a scrapbook. They started some serendipitous conversations both during and after his Boston trip.

Using the Pintailgram app, John can now quickly get to the most relevant travel review snippets. Pintailgram replaces the physical travel guides that used to follow him everywhere.

During a hallway chat, John shows Sonia some Pintailgrams from his Boston trip. She gets to learn a lot more about John through his stories. She treasures some of the cool Pintailgrams John gave her. One of them has a funny doodle on a calamari restaurant in North End.

1.8 GOALS OF THIS THESIS

This thesis has 3 main goals:

1. Trigger story creation by automated story prompts from travel reviews

2. Help create unique travel stories by remixing

3. Create travel stories that become conversation starters

1.9 THESIS OUTLINE

Chapter 1: analyses problem space and context, establishes operating definitions and scope, articulates research questions and hypothesis, introduces concepts related to storytelling, target audience, before-and-after scenarios and goals.

Chapter 2: describes research and prior work related to storytelling. Establishes principles for Pintail. Makes a case for paper based storytelling, and combinatorial creativity.

Chapter 3: user experience, architecture and device-specific design of Pintail.

Chapter 4: evaluation procedure, stories created by users

Chapter 5: conclusion, limitation, future work

Chapter 2: Background

Pintail draws on research in priming, second screens, augmentation of human intellect using technology, combinatorial creativity, self-limiting technology and conversation starters. The following sections describe the background and relevant prior work in these fields.

2.1 THEORY AND CONCEPTS

2.1.1 Priming

In chapter 1, we discussed that harvesting inspiration is one of the key challenges in storytelling. We used the analogy of storytelling as a *task* in the *operating system* of our brain. That *task* needs to be scheduled by a certain *task scheduler* before it can execute. Priming can explain what *triggers* that *task scheduler* to invoke the storytelling *task*.

Priming is the phenomenon where exposing a subject to a stimulus influences how they respond to a subsequent stimulus. For example, we process the word 'nurse' faster when it is followed by a relevant word 'hospital', compared to when followed by an unrelated word, e.g. 'dog'. Priming happens without conscious guidance or intention of the brain.

Priming can be done in multiple ways. The Pintail approach hinges particularly on positive priming, repetition priming, mere exposure effect and structural or syntactic priming.

Positive priming affects the speed of processing by spreading activation of a particular representation or association in memory just before carrying out an action or task (Reisberg, 2015). Repetition priming is a form of positive priming. In repetition priming, the brain processes later experiences of the same stimulus more quickly.

Mere exposure effect is not exactly priming, but describes how users can develop preference for things merely because they are familiar with them (Zajonc, 1968). According to a meta-analysis of 208 experiments by Bornstein (1989), mere exposure effect is strongest when unfamiliar stimuli are presented briefly.

Structural or Syntactic priming

Human speech is highly repetitious. Structural priming induces a tendency to repeat a current sentence that is similar in structure to a previously presented prime (Bock, 1986). This idea from psycholinguistics is used heavily in Pintail.

Structural priming is a form of positive priming. One specific form of structural priming is syntactic priming (Smith & Wheeldon, 2001). According to syntactic priming, the probability of a particular syntactic form being used in the description increases when that form had occurred in the prime. The frequency or recency of use of particular structural forms influence sentence formulation processes. Here is an example of priming by a common syntactic form (common phrase 'reminds me of'):

(Prime 1) Boston *reminds me of* London.

(Prime 2) Boston Public Library *reminds me of* Venice.

(Sample response) Harvard *reminds me of* Curzon Hall.

We feel fine (S. D. Kamvar & Harris, 2011), an almanac of human emotion, first utilized syntactic repetition as a form of storytelling in internet scale. We feel fine system searched newly posted blog entries in the Internet for occurrences of the phrases 'I feel' and 'I am feeling'. When it found such a phrase, it recorded the full sentence and the 'feeling' expressed in that sentence (happy, depressed, sad etc.). The feelings could then be explored using a series of playful interfaces.
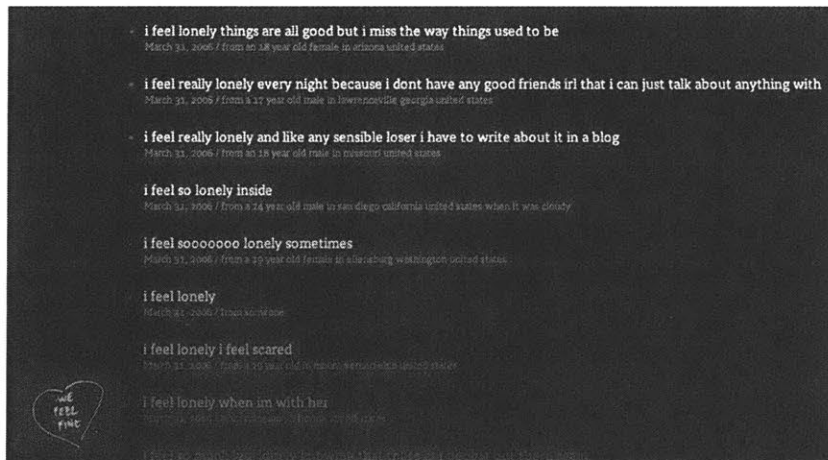
Figure 2-1. Syntactic repetition in We Feel Fine

It should be noted that 'We feel fine' was more of an information visualization art project, or an 'artwork authored by everyone'. It did not have an explicit intent to induce storytelling by eliciting structural priming or by using syntactic repetition.

2.1.2 Second screen

Second screen is the concept of using a computing device (e.g. phone, tablet or computer) while consuming broadcast content from another device, usually a television. In 2017, about 70.3% of total US population regularly used another digital device while watching TV[2]. Second screen experiences are often designed to enhance the viewing experience of specific content in first screen, e.g. live football. A common intent for today's second screens is to increase active or passive user engagement in online platforms or social networks.

The second screen in Pintail is different from traditional second screens in several ways. The content in Pintail's second screen is not directly related to the content of first screen. In addition to that, the second screen at Pintail is less interactive than the first screen. While most second screen experiences aim to increase user engagement, Pintail attempts to keep its second screen ambient and quiet.

2.1.3 Augmented writing

Doug Engelbart defined 'augmenting human intellect' as 'increasing the capability of a man to approach a complex problem situation, to gain comprehension to suit his particular needs, and to derive solutions to problems' (Engelbart, 1962). For current thesis, the problem we are interested in is storytelling, and it involves *writing* stories. Since Engelbart's 1962 paper, different writing technologies have followed different paths to approach 'augmenting human intellect'.

Most common augmentation to the written form is the augmented non-linearity from hypertext, both for fiction and non-fiction (Barrett, 1988) use cases. It is worth noting that the concept of hypertext was conceived (Bush, 1945) or coined (Nelson, 1965) before the concept of augmenting human intellect. The first hypertext fictions with 'forking paths' even predated that (Borges, 1941; Joyce, 1922).

Some augmented writing technologies today identify more as 'tools'. These writing tools evolved from being a text based tool like WordPerfect, to a WYSIWYG tool

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[2] https://www.emarketer.com/Article/Few-Viewers-Giving-TV-Set-Their-Undivided-Attention/1016717

like MS Word, to a more cloud based collaborative tool like Google Doc (Harris, 2017).

Some augmented writing technologies go beyond the definition of 'tools'. They attempt to replicate the whole intellectually meaningful experience of storytelling by generating stories on behalf of humans. One of the extreme examples of augmentation by automation is a software called Wordsmith[3]. Wordsmith can generate narratives for city guides based on structured data and templates.

Figure 2-2. Automated Seattle city guide generated by Wordsmith software

Figure 2-3. Hemingway app

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[3] https://wordsmith.automatedinsights.com/gallery/city-guide

To some writing apps, augmentation is in-situ guidance for readability and writing style. Hemingway app[4] is an online writing editor that makes writing bold and clear by analysing readability by following a simple set of rules. Those writing rules transform this app into a 'spellchecker for style'. Author Hemingway's prose was known to be so simple that even a fifth grader could understand it. Following that example, Hemingway app recommends writing at a lower grade level. It encourages to get rid of adverbs because they weaken verbs. It identifies words or sentences that are too long or complicated and guides how they can be simpler.

Another app of the same genre with a more sophisticated implementation is Textio[5]. Textio augments writing guidance to produce a better version *quantitatively* or with the help of machine learning. It does not merely rely on grammar or finite set of rules. Creators of Textio assert that in five years everything we write will be using augmented writing software (Harris, 2017). Based on a rich dataset, Textio attempts to predict how different audiences are likely to react to a composed piece. Unlike other writing editors, Textio is not general purpose. Its guidance is outcome or domain focused. For example writing a job description will result in a different set of domain specific guidance, compared to writing travel stories.

requires having a truly deep understanding of what makes our users tick.

The candidate must be an exce   Heads up!   n create exci
participate in and lead a cross-f   ractive desig
stories, concept sketches, expe This phrase draws more male   architecture
design, design research, and us   job seekers.

                                      Other choices:
The senior designer needs to b   lead   he design pi
skilled in at least one area (mot   be responsible for   n). Most imp
sufficient conviction in his designs to truly own the nuanced dimensions of
delivered is ultimately emotionally irresistible.

Figure 2-4. Textio's augmented writing user interface

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4 http://www.hemingwayapp.com/
5 https://textio.com/

2.1.4 Remixing or combinatorial creativity

The theory of "bisociation" from Arthur Koestler explains creativity as the combination of elements that don't usually go together (Koestler, 1964). This combination happens rather unconsciously in our brain (Young, 2003). Through the combination and recombination of a random pool of resources we arrive at an original idea or story. Einstein termed this concept as combinatory play (Hadamard, 2013).

If we look at storytelling as a creative exercise, it is possible to apply the concepts of combinatorial creativity systematically using some techniques (Michalko, 2010). Raskar described one such ideation technique as Idea Hexagon (Raskar, 2012).
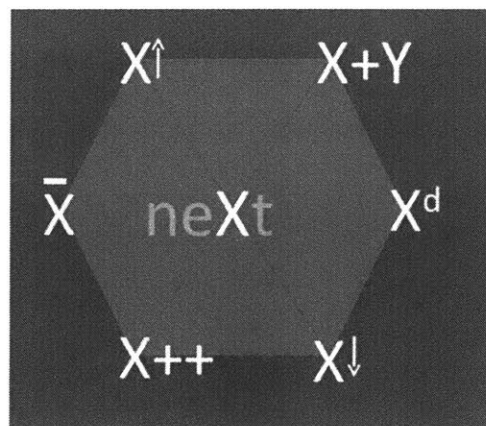
Figure 2-5. Ramesh Raskar's Idea Hexagon for combinatorial creativity

For example, an Idea Hexagon can be created by asking the question: 'After X, what is neXt?' Idea Hexagon provides hints on how six other ideas can be derived based on each new idea. If 'x' is an idea on photos, then 'x++' can be about applying the same idea on videos. Techniques like these are primarily for ideation or invention. But they can be applied to story-telling as well.

2.1.5 Self-limiting technology

Sep Kamvar first coined the term of 'Self-limiting' technology (S. Kamvar, 2012). By definition, self-limiting technologies encourage users to stop engaging with the technology when their core pursuit is fulfilled. Search engines and dating apps are prime examples of such technologies.

Self-reinforcing technologies are the polar opposite of self-limiting technologies. Examples include TV, video games and social networks. Their goal is to keep the user

engaged as much as possible. Kamvar argues that all technologies should have built in natural limits.

2.1.6 Conversation starters

Social catalysts (Karahalios & Donath, 2004) are objects that can stimulate mutual involvement to engage people in conversation. Objects can start conversations or act as conversation starters when they become social catalysts. For example, pets can become a catalyst to trigger conversation with strangers when people bring them to public spaces.

Socials catalysts are examples of how what we choose to possess become extensions of our self-identities (Belk, 1988).They are essentially our stories. We signal others that they should form an impression of ourselves based on commodities we own (Liu & Donath, 2006) or story artefacts we carry around. Those objects are evocative objects (Turkle, 2011b) by their own right. They are things that we think with, for our personal reflections, for our internal conversations. They can also act as conversation starters if they are provocative enough because of their unique form or function.

Mugshots (Kao & Schmandt, 2014), a coffee mug with a wireless OLED display, is a good example of a conversation starter artefact. It is an intimate communication device. It is an evocative object acting as a social catalyst in workplaces.

2.2 EXISTING WORK ON STORYTELLING

Pintail is influenced and informed by prior work in four types of applications: applications that explored storytelling with personal photos, applications that trigger prompts for stories, applications that come with a pre-defined format for stories and applications related to location-based storytelling.

2.2.1 Storytelling with personal photos

The rise of digital photographs changed the types of collocated social practices and collaborations around photos and enabled the offering of new forms of expressions (Lindley, Durrant, Kirk, & Taylor, 2008). The gradual shift of cameras from single-purpose image capture devices to camera-phones reduced minimal barriers to personal use or social sharing of photos and opened up new forms self-expression and self-presentation (Van House, Davis, Ames, Finn, & Viswanathan, 2005).

StoryTrack is a handheld device for recording stories with personal photos (Balabanović, Chu, & Wolff, 2000). It demonstrates that digital photos can be used to support story-based interactions that people enjoy with print photos. Using StoryTrack, people can send stories to family and friends, more easily than is possible with conventional albums or tools.

Travel Q is a community platform that allowed user to share their travel related micro activities through photos (Kim et al., 2015). It experiments with a 'questification' strategy that motivates travellers to change their photos into 'quests'. Results from its field study indicate that 'questification' is an applicable strategy for enhancing travel experience.

Personal Digital Historian is a table-top experience to help people construct, organize, navigate, and share digital collections in a multi-person conversational setting (Shen, Lesh, Moghaddam, Beardsley, & Bardsley, 2001). It aims to enable informal storytelling using personal digital data such as photos, audio and video. This project combines research in shared-display devices, real-time authoring and content-based information retrieval. Some of the goals of this project are to make the computer disappear, make it easy and fun to use across generations of users and enable exploratory storytelling that blend authoring and presentation.

2.2.2 Applications that use triggers
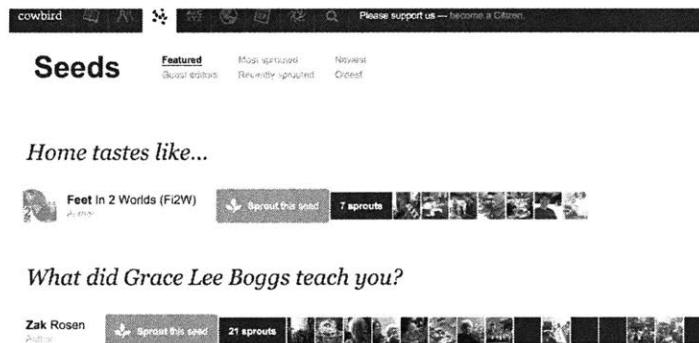
Figure 2-6. Seeds of stories in Cowbird interface

Story triggers or story prompts are open-ended questions or incomplete sentences with 'seed' topics. Cowbird, an online storytelling application[6], seeds the users with story topics with a call to action of 'sprout' each seed into new story.

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[6] http://cowbird.com

Another example is Raconteur (Chi, 2010). It is a conversational chat bot that uses this common technique of story triggers for eliciting response. Raconteur encourages people to make coherent points in travel stories. It uses a large common sense knowledge base and novel common-sense inference technique. Raconteur does natural language processing in real time in order to recommend media items from a library. However, one challenge for this system is that those media items have to be pre-tagged. That tagging can become quite tedious a process before delivering any value.

2.2.3 Applications that allow storytelling following a canned format

Storymaker[7] is an Android application for citizen-journalism by the Guardian project. It comes with a number of storytelling lessons, e.g. how to create a story out of five story clips. Unlike Raconteur, Storymaker does not use any storytelling triggers.

2.2.4 Applications for location based storytelling

Travel stories are essentially location-based stories. Serendipitous Family Stories (F. R. Bentley, Basapur, & Chowdhury, 2011) project explores how serendipity can be a catalyst for consumption of inter-generational stories. It lets users create a location-based story that the family members can discover later. It later evolved to a real-world video hunt (Storyplace.me, F. Bentley & Basapur, 2012) that allows users to create video stories and hide it. Others can unlock those hidden stories when they approach the story location. None of these two systems actually prompted the users in situ for creating their stories. They used standard push notifications for existing stories to craft the experience of serendipity. However, this serendipity sometimes made the story difficult to consume. For example, if the user was in a train and going to work, he was not be able to attend to that notification.

2.2.5   Applications for analog storytelling

In Pintail, stories are created on paper, not on any digital screens like touch screens. The deviance from digital screen follows from a critique by Bret Victor, who referred to touch screens as 'Pictures Under Glass'. In Bret's words, 'Pictures Under Glass sacrifices all the tactile richness of working with our hands' (Victor, 2011).

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[7] http://storymaker.cc

Pintail was inspired by the storytelling in analog form by BERG's Little Printer (Brown, 2011). Little Printer was a small anthropomorphic Internet of Things desktop printer. It allowed subscribing to an expanding collection of feeds comprising of news, puzzles, stories or cute messages. Those were printed on receipt-like thermal paper for consumption.

Figure 2-7. BERG Little Printer

2.3 LIMITATIONS OF EXISTING WORK

This section describes limitations of existing work or why Pintail should exist.

2.3.1 Apps that help in articulation are not contextual enough

Without a strong connection to context, it is difficult to convert subconscious triggers to conscious story creation activities.

2.3.2 Apps cannot come with more than a finite set of inspirations

Sometimes apps come pre-loaded with a set of story types that are meant to seed story creation. The supply of those seeds is almost usually limited. They do not scale gracefully. Ultimately, they can only generate a finite set of stories.

2.3.3 Apps are not designed for connected surfaces

We are heading to a time when travellers are carrying not one, but multiple connected devices. Most of the apps are not designed to take advantage of this situation. They

end up with improper task allocation between humans and devices with a sub-optimal story telling experience.

2.3.4 Apps do not facilitate remixing or combinatorial creativity

As described in 2.1.4, remixing is the idea of combining two or more story seeds, and creating something new out of it. Remixing is an example of combinatorial creativity. If storytelling apps do not leave room for remixing, it is not possible to create an infinite number of stories from a finite set of seeds.

```
    1:GOT              P01 L01 C01 Insert Align
L----!----!----!----!----!----!----!----!----!----!-------R

A Game of Thrones - Chapter 1

Bran

    The morning had dawned clear and cold, with a crispness that hinted at the    J
    end of summer. They set forth at daybreak to see a man beheaded, twenty in    J
    all, and Bran rode among them, nervous with excitement. This was the first    J
    time he had been deemed old enough to go with his lord father and his         J
    brothers to see the king's justice done. It was the ninth year of summer,     J
    and the seventh of Bran's life.                                               J
    The man had been taken outside a small holdfast in the hills. Robb thought     J
    he was a wildling, his sword sworn to Mance Rayder, the                        J
    King-beyond-the-Wall. It made Bran's skin prickle to think of it. He          J
    remembered the hearth tales Old Nan told them. The wildlings were cruel men,   J
    she said, slavers and slayers and thieves. They consorted with giants and     J
    ghouls, stole girl children in the dead of night, and drank blood from        J
    polished horns. And their women lay with the Others in the Long Night to      J
    sire terrible half-human children.                                            J
    But the man they found bound hand and foot to the holdfast wall awaiting the   J
    king's justice was old and scrawny, not much taller than Robb. He had lost    J
```

Figure 2-8. George R. R. Martin, author of Game of Thrones, writes on an old DOS machine running Wordstar 4.0

2.3.5 Technology being used is not 'slow' enough for humans

Storytelling is a product of active reflection. According to the proponents of 'Slow Technology' theory (Hallnäs & Redström, 2001), it is important that a storytelling technology is slow enough to leave room for adequate reflection and moments of mental rest. It is more desirable over efficiency in performance of story production. No wonder that one of the best storytellers of 2015 uses a technology option circa 1985 for the technology needs of storytelling.

2.3.6 Current technology is not 'self-limiting' by design

When storytelling apps are not self-limiting by design, it can lead to unhealthy consumption or indulgence in a story related activity. It is not healthy for the story producer or for the consumer. A continued indulgence may negatively influence the

way young people connect with each other. We can call this situation an example of 'Alone Together' syndrome, borrowing the term from the book where this topic was first discussed (Turkle, 2011a).

2.4 DESIGN TENETS

As we combine and distill insights from existing theories and applications, we can arrive at the following design tenets for this thesis:

1. Creation over consumption

   a. Provide infinite inspiration for creation.

   b. Compress and limit consumption.

2. Human stories over machine generated stories

   a. Augmentation, not auto-generation

   b. Remixing

3. Self-limiting over self-reinforcing technology

   a. Stories in analog form

   b. Prompts in second screen

Chapter 3: Pintail

This chapter describes the concept, design and implementation of Pintail, the travel companion experience implemented in current thesis. First, we describe the 'what' of Pintail (concept and user experience) using five narratives or use cases. Then, we describe the 'how' of Pintail (architecture and implementation details). At the end, we also touch on some of the early iterations or concepts.

3.1 CONCEPT
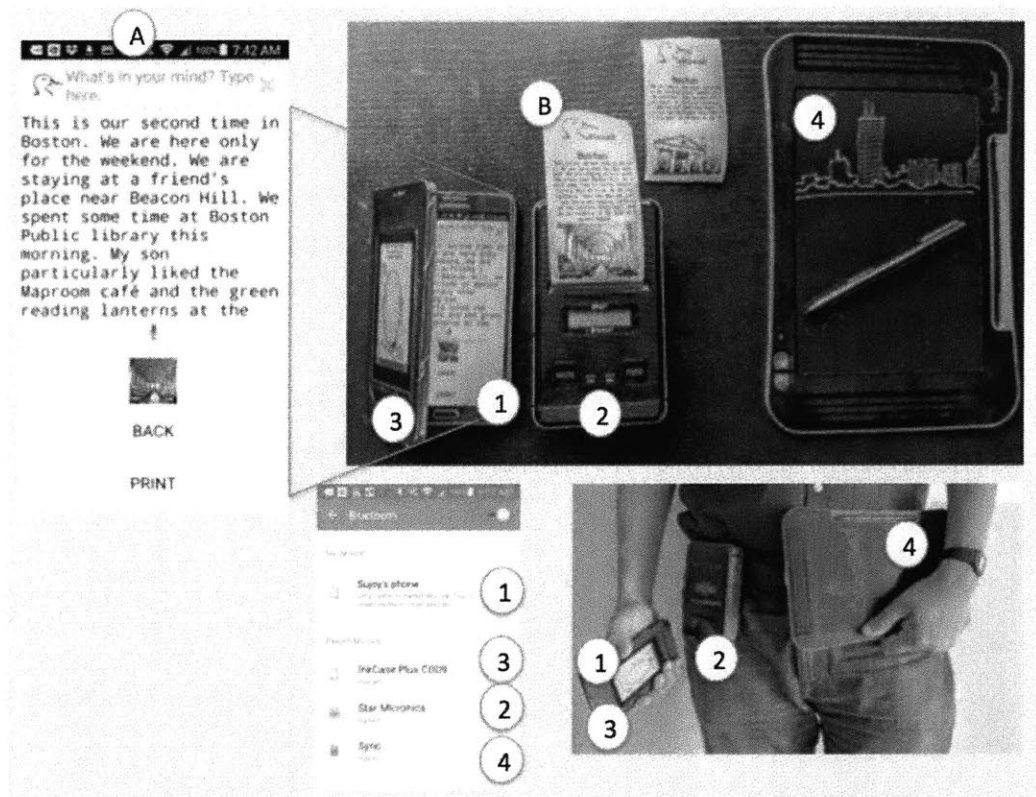
Figure 3-1. Pintail system at a glance. Pintailgram app, its (A) digital and (B) analog story artefacts. Four Pintail devices connected over bluetooth. (1) Phone with Pintailgram app (2) Pintail Printer (3) Pintail Screen (4) Pintail Slate

Pintail is a travel companion that helps create non-fiction travel stories. To inspire story creation, Pintail generates story triggers or prompts. Pintail synthesizes contextual story prompts from online travel reviews and doodle-books. These prompts guide users in creating atomic travel stories. Those stories are printed on paper and

become analog story-artefacts or conversation-starters. The printed stories are referred as 'Pintailgram' and are created using the Pintailgram app.

Before getting into the user experience and implementation details, it is important to quickly review and tie together what has already been introduced.

In Chapter 1, we introduced Pintail's connected devices (Table 1-1). Pintail resides mostly in a mobile phone. For the complete experience, Pintail extends to three more connected devices. So, Pintail is a contraption of four off-the-shelf connected devices including (1) a mobile phone, (2) a mobile thermal printer, (3) an e-ink based secondary mobile display and (4) an LCD based electronic doodling tablet.

In Chapter 1, we also established three goals of Pintail to address the problems in the domain of travel related storytelling. In Chapter 2, we distilled insights and best practices from existing theories and applications into three sets of design tenets. In current chapter, we are introducing five use cases to describe the Pintail user experience. These use cases are derived from the goals while adhering to the design tenets. The use cases and their relationships with Pintail's goals and design tenets are mapped in Table 3-1.

Table 3-1. Pintail's use cases. Relationship between use cases, goals, design tenets, corresponding Pintail devices and apps

Use cases	Goals fulfilled	Design tenets followed	Pintail devices & apps involved
1. Story prompts while writing 2. Prompt to second screen	1. Inspire	Creation over consumption ➢ Provide infinite inspiration for creation. ➢ Augmentation over auto-generation ➢ Compress and limit consumption Self-limiting over self-reinforcing technology ➢ Prompts in second screen	Pintailgram Pintail Screen Pintail Printer
3. Remix while writing 4. Remix self-generated doodles with stories	2. Remix	Human stories over machine generated stories ➢ Augmentation over auto-generation ➢ Remixing	Pintailgram Pintail Slate
5. Start conversation using analog stories	3. Start conversations	Self-limiting over self-reinforcing technology ➢ Stories in analog form	Pintailgram Pintail Printer

3.2 USER EXPERIENCE

We describe five Pintail use cases from the perspective of John, our Pintail persona from Chapter 1. John is visiting Boston for a few days. Before coming to Boston, he acquired all four devices required for Pintail experience: an Android phone, a Pintail Printer, a Pintail Screen and a Pintail Slate (Figure 3-1). He finishes up the configuration of all connected devices using the bluetooth settings of his phone. Next, he installs the Pintailgram app. During installation, Pintailgram registers all connected devices, installs apps and background services associated with Pintail Printer, Pintail Second Screen and Pintail Slate. Now Pintail is ready to guide John as a travel companion in Boston.

John is carrying the phone with Pintailgram app in his right pocket. The Pintail Second Screen is attached to the cover of John's folding phone-case. The Pintail Printer is hanging from John's belt using a built-in clip. The Pintail Slate is in his backpack. He will bring the slate out when he is in the mood for doodling.

3.2.1 Pintailgram story prompts while writing

Whenever John visits a new place in Boston or feels like telling a story, he opens the Pintailgram app in his phone. Pintailgram app encapsulates the core user experience of Pintail.
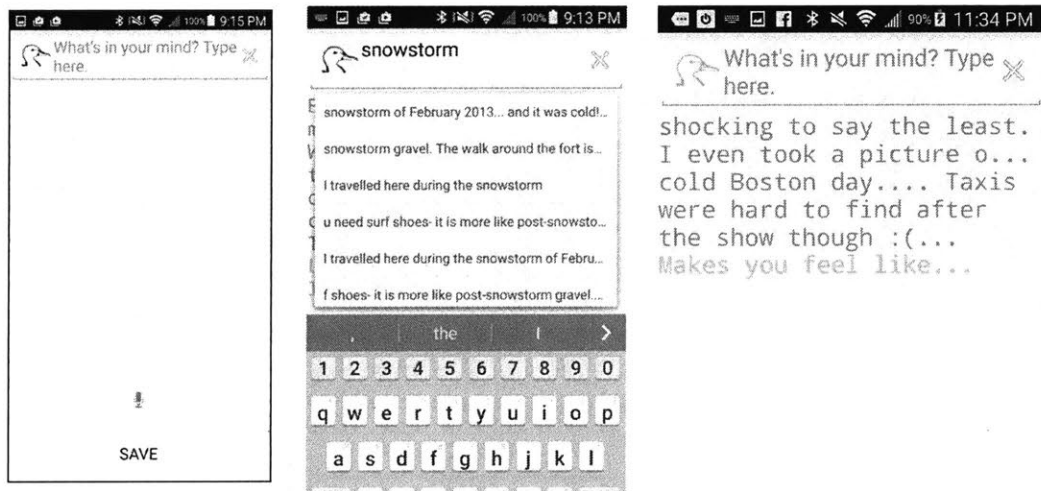
Figure 3-2. Pintailgram story prompts, story creation area and remixing interface

Pintailgram has a search-box like UI component. It encourages John to input whatever is in his mind and auto-completes. As he starts typing, he notices a list of sentences

starting with the letters he has already typed. Those sentences serve as story prompts. They are pulled from travel reviews close to John' location.

If John likes a particular prompt, he can click on it. When John clicks on a prompt, it is appended to the text pane underneath. That text pane is the story creation area.

Clicking on a story prompt clears the current prompt and moves on to the next prompt. The very exercise of selecting a story-phrase from a drop-down menu is designed to prime John with story ideas.

Story prompts are completely optional. If John doesn't like them or if prompts are distracting to him, he can turn the story prompt feature off. He can do so by toggling the Pintail icon in the search box.
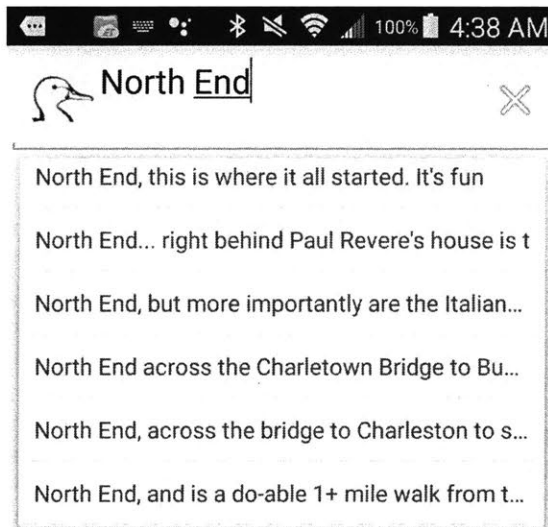
Figure 3-3. Pintailgram Context seed or prompt seed ('North End') and associated story prompts

Pintailgram app is capable of priming John with story prompts not only after he types a word, but also before he types anything. When a particular context is sensed by Pintail, e.g. a location, or time of the day, Pintail pre-fills the search box with that context seed or prompt seed. For example, if John is near North End of Boston, Pintail may pre-fill 'North End' in the search box. When John starts interacting with the search box, he then immediately finds a list of story prompts that have 'North End ...' somewhere in the phrase. After selecting one of those North End related prompts, the next pre-filled seed is about the day of the week, e.g. 'Wednesday' (because it is Wednesday). Thus Pintail prompts John with the idea of writing a sentence about

going to North End on a Wednesday. This goes on until Pintail exhausts all Prompt seeds it can sense from John's context. Or until John mutes the Prompt seed suggestions by toggling off the Pintail icon in the search box.

John can also add text using his voice input. When chosen, voice input is converted from speech to text in real time. Prompts are not available in voice input mode.

3.2.2   Remix while writing

The story creation area in Pintailgram is optimized for remixing prompts. Ideally, after John adds a number of phrases or prompts to the story creation area, he is expected to complete the story based on those story prompts.

Prompts are not complete sentences. So John has to act or operate on each prompt to make it useful. To operate on a prompt, John has to replace the ellipses to complete the sentences. Sometimes John deletes a few words and adds his own. Sometimes he replaces the whole seed phrase with a new sentence of his own. The incompleteness of those phrases helps John absorb the syntactic structure and reuse it to express his own story.

John also receives a passive signal from Pintailgram interface on when to stop adding more prompts from others and start remixing or creating his own story. At the bottom of story creation area, current word-count and estimated reading times are displayed, This counters are inspired from the Hemingway app[8]. The incremental counters for words reading time together serves as a passive signal to John and enables him to make a conscious choice about the length of the story. When there are multiple prompts in the remixing or creation area, the last added prompt is styled differently to indicate recency.

After John is done with creating the text part of the story, he is asked to choose a picture related to that story. The image picker sorts images based on John's location. Pintailgram app does not allow attaching more than one picture per Pintailgram.

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[8] http://www.hemingwayapp.com/

3.2.3 Remix self-generated doodles with stories
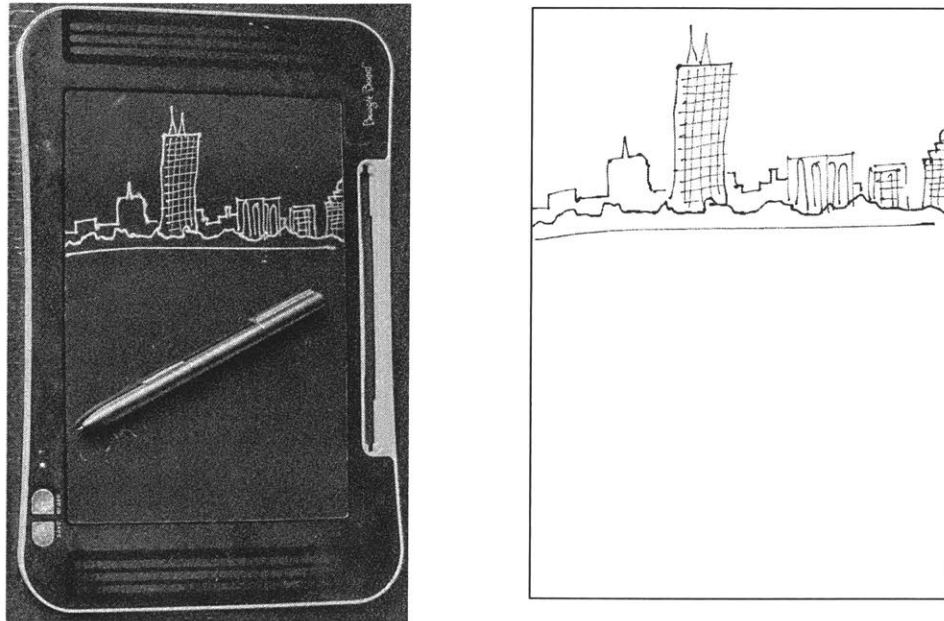
Figure 3-4. Pintail Slate implemented using Boogie Board Sync electronic doodling tablet with stylus, 'save' and 'erase' buttons (Left). Sample doodle image (right)

In Pintailgram's image selection phase, instead of attaching a picture, Pintailgram app also allows John to attach a doodle previously drawn by himself. It should be noted that these doodles were not originally captured on the Android phone or using the Pintailgram app. Unlike photographic captures, John's doodles are drawn on Pintail Slate, the LCD based electronic doodling tablet. That flow is described below.

John doodles on the Pintail Slate whenever he wishes. His intent to doodle may or may not be influenced by a doodle prompt in Pintail Screen described in 3.2.5. When John feels like doodling, he brings out Pintail Slate from his backpack. He starts doodling on the tablet. After his doodle is complete, John presses the physical save button in the Pintail Slate device. That stores a PDF line drawing of the doodle in the native storage of the Pintail Slate. Within a short interval, a background service running on the Android phone fetches the last doodle from the Pintail Slate, converts from PDF to image behind the scene and makes it available for Pintailgram image picker. After that point, John can pick that doodle for any subsequent Pintailgram.

3.2.4 Start conversation using analog stories
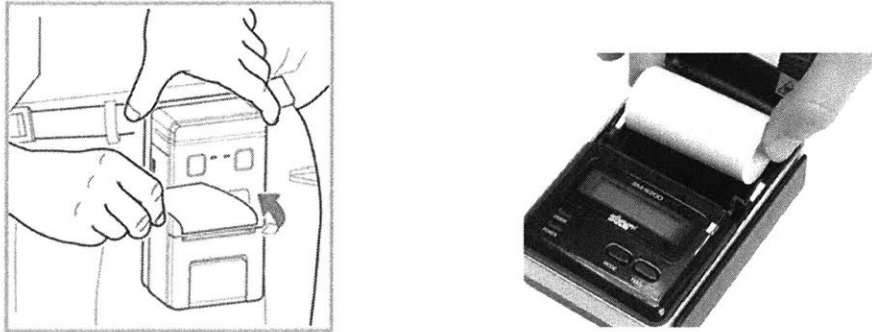
Figure 3-5. Pintail printer. How it is worn (left), how it is refilled (right)

After the selection of image or doodle, John can print the story using the 'Print' button in the Pintailgram app interface. This request is then routed to the Pintail Printer app without any interstitial UI. Pintailgrams are like Instagrams, but with Pintail assisted text, and printed on receipt paper using an off-the-shelf receipt printer. Unlike Instagrams, John can only share Pintailgrams during face to face interactions or conversations.

John usually carries his Pintailgrams in a mini travel notebook. Whenever John is casually hanging out or has some down time during transit, those Pintailgrams become good conversation starters with fellow passengers or people around him. He makes it a point to give away at least one Pintailgram to each person he has a meaningful conversation with during or after his trip. Some of his Pintailgrams find their places in his travel scrapbook, or travel corkboard.
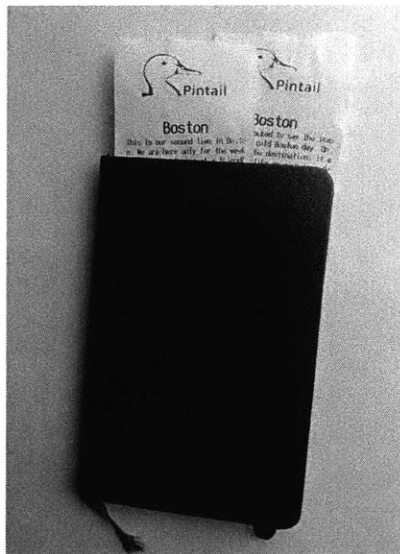
Figure 3-6. Pintailgrams tucked inside a travel notebook

3.2.5 Prompt to second screen
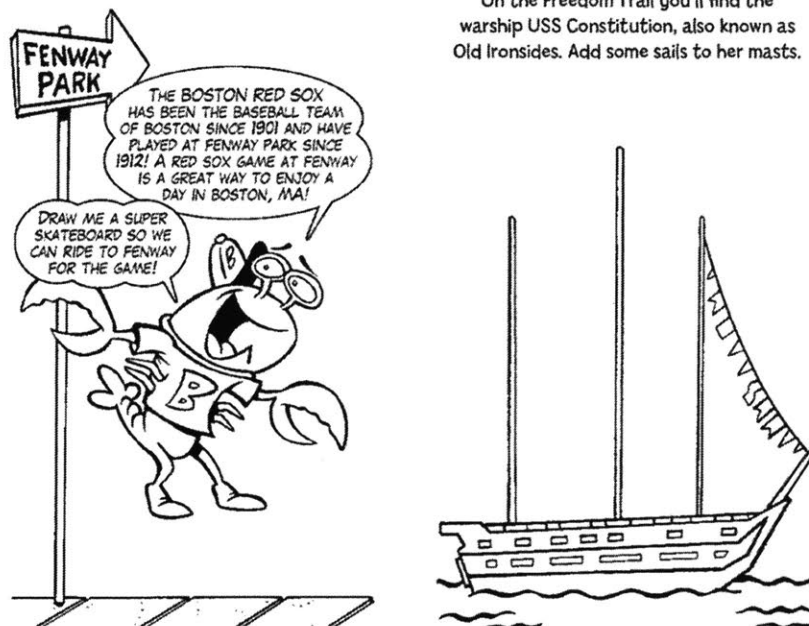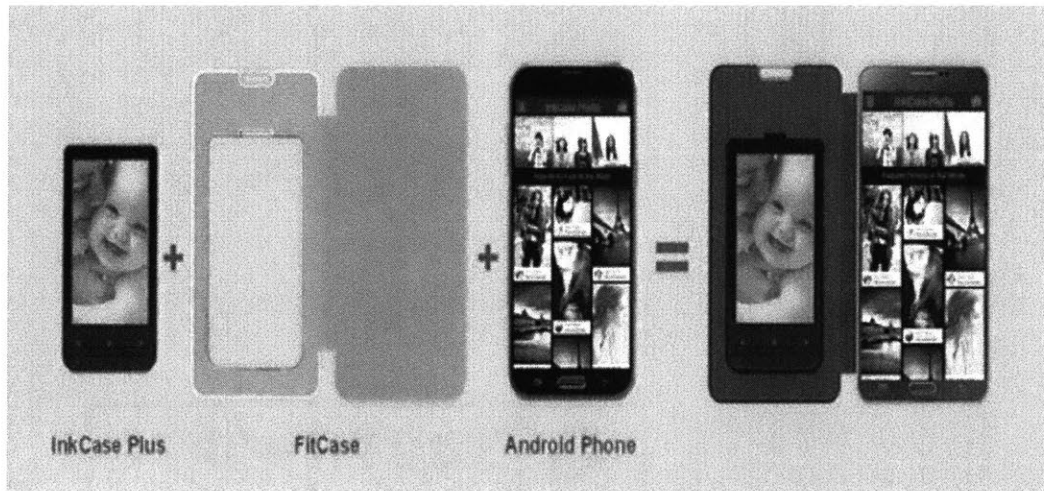
Figure 3-7. Pintail screen attached to android phone cover as a 'second screen' (Top).
Pintail Screen prompt on Fenway Park (Bottom left) Freedom Trail (Bottom right)[9]

Pintail provides prompts for story creation both interactively and non-interactively. While authoring the text part of Pintailgrams, the story prompts are provided interactively. The asynchronous story prompts appear in Pintail Screen, which is an e-ink based secondary display for mobile phones. These non-interactive prompts are

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[9] From City Doodles Boston by Chris Sabatino

visual doodles. They are adopted from the book 'City Doodles Boston'(Sabatino, 2013).

The doodle prompts in the Pintail Screen are related to the places where John is currently located. The goal of this screen is to inspire John ambiently. They contain specific instructions taken from the City Doodles Boston book (Sabatino, 2013). If there is no match of location, this service then checks for any other match between current context (e.g. weather, time of the day, season) and the transcribed text of the doodles stored. If no matches are found, then a random doodle is selected for the screen every 5 minutes.

If one of those piques John's interest, she can draw a doodle in Pintail Slate as described in 3.2.3.

3.3 SYSTEM ARCHITECTURE
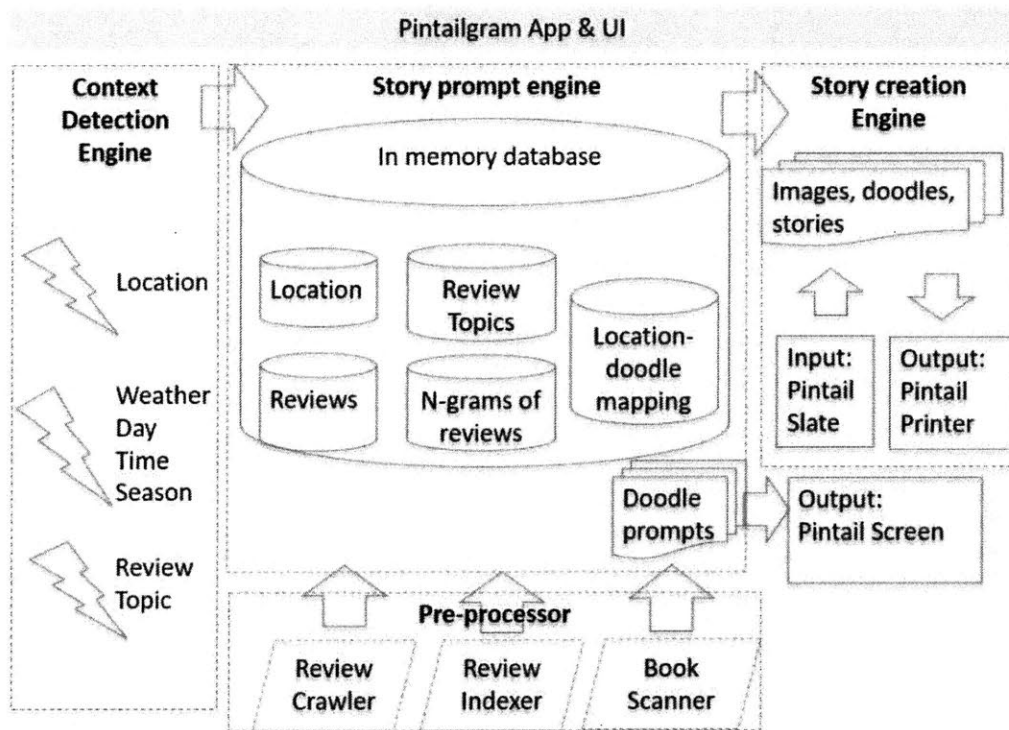
Figure 3-8. High-level architecture of Pintail

The user experience of Pintail is accomplished by software implementation of three main logical components:

1. Story creation engine

2. Story prompt engine

3. Context detection engine

Before these engines start operation, a pre-processing stage takes care of review scraping, data preparation and manual scanning of doodle prompts.

The **Pintail story creation engine** is responsible for creation and packaging of Pintail stories (or Pintailgrams). It comprises Pintailgram Android app, a background service for Pintail Slate and an app for Pintail Printer.

The **Pintail story prompt engine** is responsible for inspiring the user in creating both text-based and doodle-based stories. It comprises Pintailgram Android app, a background service for Pintail Screen and an in-memory database.

The **Pintail context detection engine** is responsible for determining the current state of context related variables (e.g. location, time of the day, weather etc). If there is a match between current context and review topics or n-grams, Pintailgram App updates the set of text prompts currently active in the Pintailgram interface. Pintail Screen also keeps the doodle prompts in Pintail Screen updated matching current location.

In –memory database: The in-memory database is the collection of all story prompts and prompt related meta-data. It consists of the following:

1. **Location database:** The locations in location database are scraped from an online travel review site (TripAdvisor)[10]. It has longitude, latitude and location-name information. These locations are usually names of points of interest. E.g. Faneuil Hall.

2. **Review database:** The reviews are scraped from an online travel review site (TripAdvisor). It has text-based travel reviews mapped with each location.

3. **N-grams database:** N-grams are pre-computed and indexed from the raw travel reviews using LightSide tool[11]. 5-grams are primarily used for the context detection engine.

4. **Review topics database:** Review topics are high level categories of story prompts provided by Pintail. They are pre-computed from the raw travel reviews with the

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[10] TripAdvisor (tripadvisor.com)
[11] LightSide tool: http://ankara.lti.cs.cmu.edu/side/

help of LightSide tool using a bag of words or finite number of syntactic patterns and n-grams.

Specific instance of a review topic is called a 'Prompt seed'. For example, 'Summer' is a Prompt seed for 'Seasons' review topic. Synthesis of review topics and story prompts are detailed in a subsequent section.

The counts of how many reviews are available in the scraped database for each review topic in each location is also tracked in the database. These counts help later determine which review topics to prioritize as prompts for any particular location.

Table 3-2. Different Review Topics and their definitions

Review topic	Definition
FEEL	These are sentences where users express some feelings or emotion about a location, in the form of "I feel ..." or "We feel ...".
WEATHER	Reviews talking about weather, e.g. summer, winter etc.
DAY	Where review contains reference of any of the seven weekdays
_TIME_OF_DAY_	Reviews containing words like morning, evening, noon
MONTH	Reviews talking about any of the twelve months
SEASONS	Reviews containing names of any of the six seasons
_TAKE_PHOTO_	Reviews suggesting if it is a good idea to take a photo in current location
_IS_IT_RECOMMENDED_	Reviews where users explicitly recommend or do not recommend that place
LOCATIONS	When review of current location contains reference of another location. For example: a reviewer might be mentioning 'Harvard' while writing about 'MIT'. That review would be relevant and contextual to the user both when the user is at MIT or at Harvard.
PLANNED	Reviews talking about plans about visiting a place
_REMINISCENT_OF_	When users mention in the review that a place reminds them of another place
_TRAVELING_TOGETHER_	Reviews mentioning if a person is travelling with another person

	(e.g. his wife)
_KIDS_CHILDREN_	Reviews talking about whether a location is kids friendly, or if children liked that location

Table 3-3 Review topics, Prompt seeds and the Story Prompts they generate

wednesday

Wednesday evening because admission is free...

Wednesday afternoon (after 3p.m.) by our troll...

Wednesday but my concern was it might be cr...

wednesday to friday. Through admission is hig...

Wednesdays- after 4 it is free. But they do ask fo

Wednesday this time of year. The museum is w...

Review topic: Day

Prompt seed: Wednesday

i feel

I feel like we didn't fully get what we paid for.

I feel like you can find something that everyone I

I feel a little bit confused,' quoted pat. This ma

I feel good about showing my kids how scienc...

I feel about Boston.

I feel I have a better appreciation of American Hi

Review topic: Feel

Prompt seed: I feel

recommend

recommend the calamari, oysters, and shrimp...

recommended for all ages. Very touching and...

recommendation of a friend to Boston's MFA....

recommend reading the marker on the sculptu...

recommend a visit especially if you can get in...

recommended

Review topic: Recommend

Prompt seed: Recommend

must see

must see. Copps Hill is the best. all in all a ful

must see. Also make sure to go to the museu...

must see. The genergetic red-headed guide up...

must see place!! Be sure you have time to do t...

must see list for Boston.

must see sights of Boston. We especially love...

Review topic: Recommend

Prompt seed: Must see

planned to ✕ — 3:02 PM

planned to visit this museum as part of a "Go S...

planned to walk the freedom trail by myself wh...

planned to go to the Pru to see the view. It was a

planned to stay 90 minutes but we took about...

planned to visit the Children's Museum on our...

planned to walk the Freedom Trail but as my h...

Review topic: Planned

Prompt seed: planned to

reminds ✕ — 3:04 PM

reminds us of all that once was good, and that...

reminds me of Little Italy in NYC, but much cle...

reminds me a little bit like Kensington Garden/...

reminds me of similar things back home

reminds me of Central Park, but less crowded...

reminds one of the old Barnes museum but wit...

Review topic: Reminiscent

Prompt seed: reminds

take a photo of ✕ — 3:07 PM

anquil but you can't sit in it or take a photo of

talian neighborhood. I decided to take a photo...

job, and she was very kind to take a photo of m...

the history of the park. They take a photo of yo...

il but you can't sit in it or take a photo of it. We...

an neighborhood. I decided to take a photo of t...

Review topic: Take a photo of

Prompt seed: Take a photo of

raining ✕ — 3:06 PM

raining and wasn't super impressive. The stingr...

raining these beautiful horses. This is a MUST...

raining and they had a heated tent to stand in...

raining in courtesy, especially the ones who we...

raining or snowing. Signers of the Declaration,...

raining and there's a beautiful view of the Bost...

Review topic: Weather

Prompt seed: raining

traveling with ✕ — 3:02 PM

traveling with families as well as for anyone look

traveling with children but we were a group of all

traveling with children. There is also a beautiful

Traveling with a group of high school journalists,

traveling with young kids I highly recommend t...

traveling with 3 kids, and the whole trail would h

Review topic: Travelling with

kids ✕ — 3:00 PM

kids can run and roll around, dogs are on their ex

kids - binoculars, fun activities, etc. This is a

kids and adults. They have sellers that sell hats

kids running around excited to be there. $5 Ph...

kids were playing in the pond, adults were havi...

Kids of all ages would enjoy it. The videos wer...

Review topic: Kids, travelling with

Prompt seed: Traveling with	Prompt seed: kids

3.4   IMPLEMENTATION

3.4.1   Implementation: Scraping and Pre-processing of reviews

For the purposes of Pintail, a review dataset is crucial for synthesizing story prompts. To that end, total 31435 reviews related to 188 locations in Boston and Cambridge were scraped from Tripadvisor.com. Python[12] scripts were used for scraping, and lxml.html[13] package was used for parsing HTML. Then LightSide tool was used to create n-grams (bigrams, trigrams, 4-grams, 5-grams, 6-grams and 8-grams) from the review text to understand which of these n-grams have the most potential as story prompts. Based on this data analysis, 5-grams were deemed to be the best candidates for synthesizing story prompts (Appendix A2, A3).

Table 3-4. Pseudo code for scraping reviews

```
Boston = city( '60745', 'Boston_Massachusetts' )
Cambridge = city( '60890', 'Cambridge__Massachusetts')
city_list = {Boston, Cambridge}
for city in city_list:
        location_list = get_all_locations(city);
        for location in location_list:
                review_id_list = get_all_reviews_in_all_pages(location);
                for review in review_list:
                        tripadvisor_url = "http://tripadvisor.com"
                        tripadvisor_link_format = "/ShowUserReviews-g{city.city_id}-
d{location.location_id}_id-r{review.review_id}-{city.place_name}-
{city.city_name}.html#REVIEWS"
                        scrapedReview = scrapeReview (tripadvisor_url,
tripadvisor_link_format);
```

After the n-gram analysis step, review topics were manually defined following a bag of words listed in Appendix A4. Finally, the frequency of review topics (aka hits) was computed using LightSide tool. See Appendix A5 for an example of different n-gram counts on the 'feel' review topic. This frequency is useful to compute the order of n-grams or review topics that would become candidates for story prompts.

For descriptive data related to scraped reviews, n-grams and review topics, please check Appendices A1-A5.

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[12] https://www.python.org/
[13] http://lxml.de/lxmlhtml.html

Why 5-grams were chosen over 8-grams for review topics

One interesting observation from the pre-processing stage was that the longer the n-gram is, the more location specific unique stories can be discovered from them. For example, one of the top 8-grams was 'One if by land, and two if by sea'. It is related to Paul Revere's[14] famous ride, as depicted in the following poem by Henry Wadsworth Longfellow:

"One if by land, and two if by sea

And I on the opposite shore will be,

Ready to ride and spread the alarm

Through every Middlesex village and farm,

For the country folk to be up and to arm."

Another top 8-gram was 'Not a bad seat in the house', which is a famous show at Huntington Theater[15].

Although 8-grams were better than 5-grams for exposing interesting location specific stories, they have the downside of being too specific. They were also too few to ensure a steady supply of story prompts. The sum of hit-counts for top ten 8-grams was 215, compared to 1619 for the same sum of top ten hit-counts from 5-grams. Also, there were also more duplicates in 8-grams than there were in 5-grams, which meant more manual post-processing was required. For that reason, 5-grams were chosen for synthesizing review topics.

3.4.2 Implementation: Synthesis of prompts in Pintailgram app

Pintailgram app spans across all three logical pieces of Pintail architecture (story creation, story prompt and context detection engines). One of its key functions is to synthesize story prompts and present them in real time as the user is typing. Another key function is to synthesize Prompt seeds, the contextual text in the search interface, even before the user types anything. Since the latter function involves generation of both prompt seeds and story prompts, it is described below using pseudo code.

---

[14] https://www.wikipedia.com/en/Paul_Revere
[15] https://www.tripadvisor.com/ShowUserReviews-g60745-d2500460-r427332802-Huntington_Theatre-Boston_Massachusetts.html

The pseudo code in Table 3-5 is run when the user opens the Pintailgram app. It helps the Pintailgram back-end to pre-compute an array of prompt seeds before the user types anything. These prompt seeds are presented one after another until the user choses one of the story prompts or decides to write something in the search box.

Table 3-5. Pseudo code for synthesis of Prompt seeds and Story prompts from Context, Review topics and N-Grams

```
#longitude, latitude from phone GPS
location = getCurrentLocation();

#fetches closest location name from Location database
location.name = getLocationName(location.longitude, location.latitude);

#sunset time from api.openweathermap.org/data/2.5/weather?lat={lat}&lon={lon}
#converts current time in current location to morning|afternoon|evening|night
context.timeOfDay = getCurrentTimeOfDay(location.longitude, location.latitude);

#api.openweathermap.org/data/2.5/weather?lat={lat}&lon={lon}
#output cloudy| windy| sunny| foggy| cold| hot| drizzling| hail| rain| snow| storm|
blizzard| thunder| showers| tornado
context.weather = getCurrentWeather(location.longitude, location.latitude);

# sunday| monday ... |saturday
context.weekday = getCurrentWeekDay(today);

#summer|winter|fall|spring
context.season = getCurrentSeason(today);

#January|February|March|April ... |December
context.month = getCurrentMonth(today);

prompt_seeds.add(location.name);
prompt_seeds.add(context.timeOfDay);
prompt_seeds.add(context.weather);
prompt_seeds.add(context.weekday);
prompt_seeds.add(context.season);
prompt_seeds.add(context.month);

#Query Review Topics DB for top review topics in current location by frequency
review-topics = getTopFiveReviewTopics(location);
for reviewTopic in reviewTopics
        prompt_seeds.add(reviewTopic);

#Query n-grams DB for top n-grams in current location by frequency
ngrams = getTopNGrams(location);
for ngram in ngrams
        prompt_seeds.add(ngram);

#Query review-topics, ngrams, review and locations DB for sorting prompt_seeds by
frequency
prompt_seeds.sortByFrequency(location);
```

```
for prompt_seed in prompt_seeds
    #Query review database for matching reviews based on prompt_seeds
    matched_reviews = getMatchingReviews(prompt_seed);
    for matched_review in matched_reviews
        #compress review to fit in a single row of prompts list
        prompts.add(matched_review.trim());
```

3.4.3 Implementation: Pintail Printer app

Pintail repurposed the STAR SM-s220i 2″ (58mm) iOS & Android Bluetooth MFi Mobile printer for printing Pintailgrams. SM-s220i is a portable thermal printer commonly used for receipt printing. Pintail Printer is implemented by extending its Star Micronics Developer SDK[16].

Three types of content are printed by Pintail Printer:

1. Plain text (story title and text)

2. Raster graphics (pictures taken by user and selected for Pintailgram)

3. Vector graphics (doodles drawn by user and attached to Pintailgram, any maps data)

Figure 3-9. Raster graphics without (left) and with dithering (right)

How images are printed

For printing raster graphics using Pintail Printer, the images have to be dithered before printing. Otherwise there are patches of black in the print. For vector images (doodles, maps), no dithering is required. Dithering is a technique for using the illusion of depth in images displayed using a limited color palette, for example in

---

[16] http://www.starmicronics.com/support/sdkdocumentation.aspx

thermal printers. Colors and tones are approximated using a diffusion of pixels. This dithering is done using Floyd-Steinberg algorithm[17]. This algorithm is already implemented by the printer SDK.

3.4.4   Implementation: Pintail Screen

Pintail Screen is implemented using InkCase Plus screen and FitCase case for Android devices[18]. Pintail Screen is implemented as a background service by extending Android InkCase library[19]. This service checks current location of the user once every five minutes. If there are doodles-entries for current location in the in-memory database, the corresponding doodle is loaded from the file-system and exported to the second screen. If there is no match of location, this service then checks for any other match between current context (e.g. weather, time of the day, season) and the transcribed text of the doodles stored in the in-memory database. If no matches are found, then a random doodle is selected for the screen every 5 minutes.

Pre-processing of Doodle prompts for Pintail Screen

A fixed number of doodle prompts are sourced from the city doodle book for Boston (Sabatino, 2013) manually using a scanner. A mapping is established in the database between the page-number/ file-names of the doodle prompts, the text of the doodle prompt, and locations where the doodle will be relevant as a prompt etc.

3.4.5   Implementation: Pintail Slate

Pintail Slate is implemented by using BoogieBoard Sync[20] and BoogieBoard Sync SDK[21]. Pintail Slate is implemented as a background running service for Android. After a drawing is complete, the user presses the save button in the BoogieBoard device. The image is stored as a PDF line drawing in the native storage of the device. The background service connects with the device using Bluetooth. It navigates to the directory where the images are stored, downloads the most recent PDF and converts it into a PNG file using PDfbox Android library[22].

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[17] https://www.wikipedia.com/en/Floyd%E2%80%93Steinberg_dithering
[18] https://www.kickstarter.com/projects/378232716/inkcase-plus-e-ink-screen-for-android-phone
[19] com.gajah.inkcase library
[20] http://www.myboogieboard.com/ewriters/sync
[21] https://github.com/kent-displays/boogie-board-sync-sdk-android
[22] https://github.com/TomRoush/PdfBox-Android

3.5 EARLY ITERATIONS AND INCOMPLETE CONCEPTS

Three early iterations of Pintail explored concepts that were not completed later or abandoned for a number of reasons. They are:

1. Haiku-bot

2. Pintail Scrapbook

3. Pintail Slides

3.5.1 Pintail Haiku-bot

Pintail Haiku-bot was an early experiment to generate mini travel Haikus out of travel reviews. This concept was not developed further because a design tenet was established to favour human generated stories over machine generated stories.

Table 3-6 UROP project: Haikus generated from travel reviews in Boston Common

the art exhibit	the colorful fall	the metallic ducks
fall colors , the civil war	fall wardrobes , a pleasant walk	fall colors , a pleasant walk
the metallic ducks	the heritage trail	the happy tourist
the heritage trail	a cooler planet	early residents
weather is , outdoor concerts	interspersed , the fall colors	weather is , shitty music
disciplined flowers	the happy tourist	the happy tourist

The Haikus were based on a fixed template that could only generate Haikus of three lines with predetermined number of syllables. The first iteration combed text for strings of 5 or 7 syllable word sequences, and ranked them based on the average rarity of a word, on the assumption that rarer words are more useful and convey more.

The concept of Collocates[23] or nearby words was explored for this concept. Collocates provide information on word meaning and usage, following the idea that "you can tell a lot about a word by the words that it hangs out with". Collocates are grouped by part of speech and then sorted by frequency[24]. For this concept, a frequency and part of speech dataset of 5000 words was used from http://www.wordfrequency.info/. NLTK[25] was used for syllable counting. Since real

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[23] https://www.collocates.info/
[24] http://www.wordfrequency.info/.
[25] https://www.nltk.org/

time syllable counting of NLTK was slow, previously computed syllable data needed to be stored in a local database.

3.5.2 Pintail Scrapbook
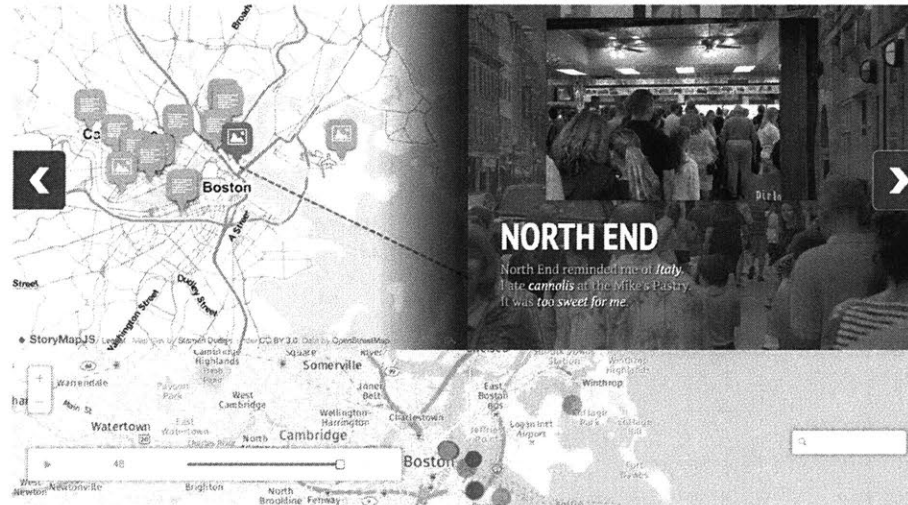
Figure 3-10. Pintail Scrapbook.

Pintail Scrapbook was a web-based mash-up of slideshow and maps. It had a location-based slideshow at the top, and a map-animation of visited places at the bottom. Its implementation was not completed to prioritize implementation of Pintailgram concept.

In the Pintail Scrapbook concept, the top-pane was planned to be implemented using StoryMap.JS[26] by local hosting of StoryMap.JS. The bottom pane was a CartoDB-Torque temporal map[27] based on 2 days worth of Google location data of a Boston visitor. The CartoDB map had a viz.json file. The plan was to generate that JSON file based on location data during trip time. In the screenshot above, each word in italic was supposed to be a response to a contextual pintail query by the user.

3.5.3 Pintail Slides

Pintail Slides was a phone based concept. It was supposed to be a digital repository of all Pintailgrams. This concept could not be implemented with end-to-end functionalities due to time constraints.

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[26] https://storymap.knightlab.com/
[27] https://github.com/CartoDB/torque
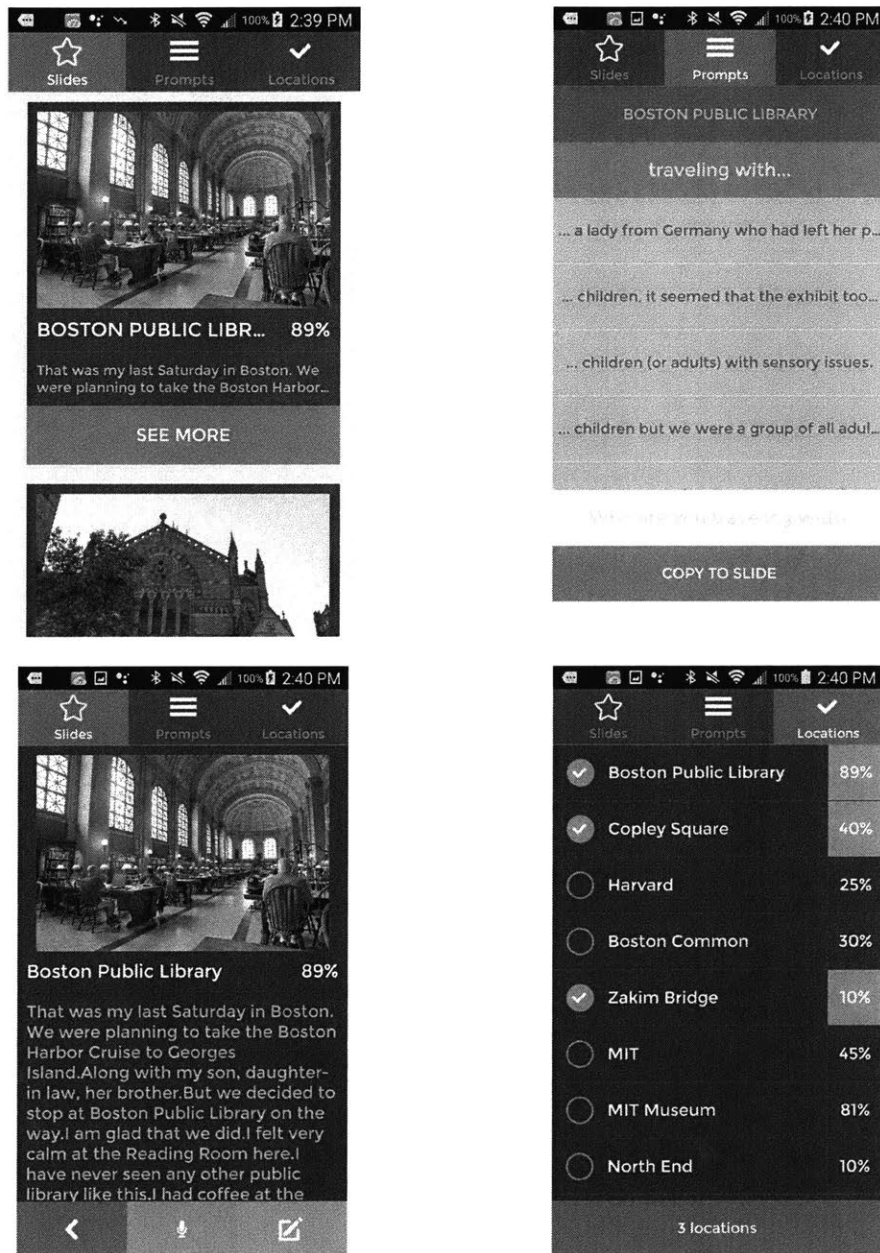
Figure 3-11. Pintail Slides. User interface for Slides tab, Prompts tab, Locations tab and slide details page (clock-wise from top left)

Pintail Slides app UI had three tabs: Slides, Prompts and Locations. Locations tab had a check-list like user interface to store all the planned and desired locations by the user. Prompts tab was a pre-cursor to Pintailgram. The user was supposed to explore review snippets in that tab and only copy the ones to the Slides tab that he wanted to remix. The slides tab stored all draft and completed micro-stories (which later evolved into Pintailgrams).

Chapter 4: Evaluation

Pintail was tested with 5 users in total. 3 of them were tested with Pintailgram. 2 of them were tested with Pintail Slate.

4.1 PROCEDURE

Because of extreme weather condition, the exact procedure for user study described in Appendix B could not be followed. During the study, the users received a mobile device from the investigator where Pintail was pre-installed. Then users were briefed about Pintail. They were asked to create travel stories based on their experiences in their favourite Boston locations.

The investigator accompanied the users for up to thirty minutes to observe contexts of app usage. In person interviews took place after each study session and lasted less than 30 minutes.

The investigator took notes manually while the Pintail app was being used. No audio, video or photographs of users was digitally recorded during app usage or during interview.
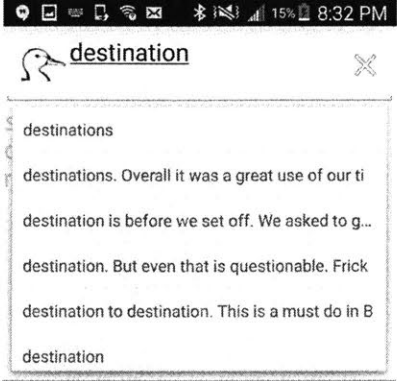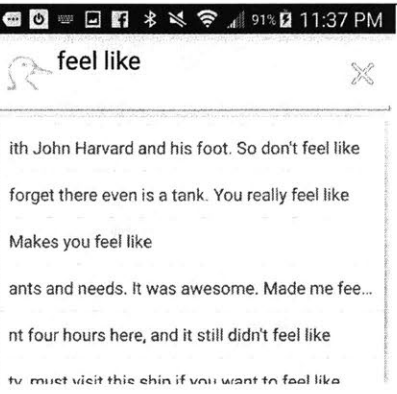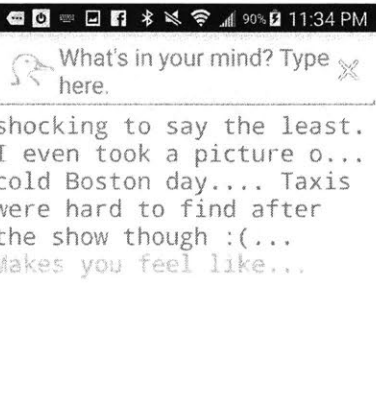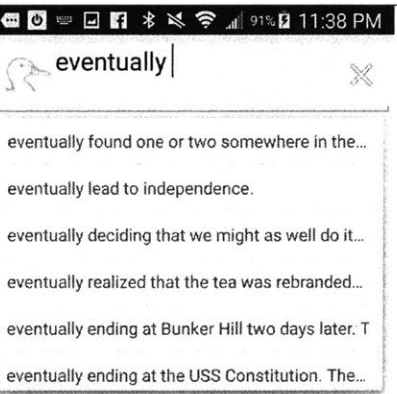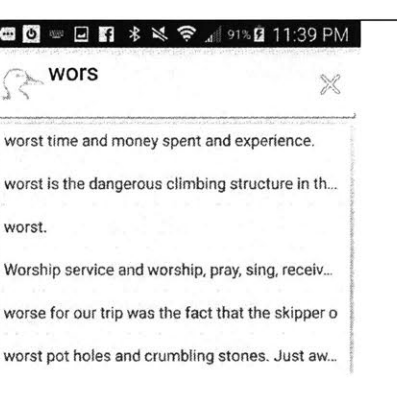
The usability of Pintail was measured using a standard version of System Usability Scale (Brooke, 1996). The desirability of Pintail was measured using 118 product reaction cards of Microsoft's desirability toolkit (Benedek & Miner, 2002).

4.2 USER 1: PINTAILGRAM

The first user was recruited at the MIT Student Center. This user was from Uganda. He was visiting MIT campus as a research scholar. This user asked some clarifying questions to understand the concept of prompts and how they can be remixed. The following table describes sequentially the text he tried to provide as input and the prompts Pintail presented him with.

Table 4-1. Pintail prompts for user 1

User typed	Prompt from Pintail	What prompt was selected for remix
shock	_shock_ shocking to say the least. I even took a picture o shock me that this is one of the most beautiful... Shocking since this isn't a hangout type of plac... shocked when I got a plate of at least 40 huge... shocking. There are decent places to go in the... shocked because I felt like I was 20 years old a...	What's in your mind? Type here. shocking to say the least. I even took a picture o...
cold	_cold_ cold as hell for this Texas girl. The food and atm cold and windy the day we were there, and ever... cold Boston day. cold when I was there. But the sun was shining... cold beer, hot dog and peanuts being thrown b... cold walk usually - so this was a nice treat. And	What's in your mind? Type here. shocking to say the least. I even took a picture o... cold Boston day....
taxi	_taxi_ taxi from Boston, which I would highly recomm... taxi driver was very knowledgable and gave us... taxi that was going past (no taxi ranks there). taxi to the airport. Last summer I visited a frien taxis available, after the game. The vendors ev... taxidermy etc. to the Peabody Museum which...	What's in your mind? Type here. shocking to say the least. I even took a picture o... cold Boston day.... Taxis were hard to find after the show though :(...
alight	No prompts were available for 'alight'.	No prompt was generated.

destination (on arrival at the destination)	**destination** destinations destinations. Overall it was a great use of our ti destination is before we set off. We asked to g... destination. But even that is questionable. Frick destination to destination. This is a must do in B destination	No prompt was selected.
feel like (feel like in deep freezer)	**feel like** ith John Harvard and his foot. So don't feel like forget there even is a tank. You really feel like Makes you feel like ants and needs. It was awesome. Made me fee... nt four hours here, and it still didn't feel like ty, must visit this ship if you want to feel like	What's in your mind? Type here. shocking to say the least. I even took a picture o... cold Boston day.... Taxis were hard to find after the show though :(... Makes you feel like...
eventually	**eventually** eventually found one or two somewhere in the... eventually lead to independence. eventually deciding that we might as well do it... eventually realized that the tea was rebranded... eventually ending at Bunker Hill two days later. T eventually ending at the USS Constitution. The...	No prompt was selected.
'worssed' (typo by user, meant 'worst')	**wors** worst time and money spent and experience. worst is the dangerous climbing structure in th... worst. Worship service and worship, pray, sing, receiv... worse for our trip was the fact that the skipper o worst pot holes and crumbling stones. Just aw...	No prompt was selected.

User 1 was quite patient in editing or remixing the story prompts into his own version. The investigator helped him try different keywords for his (user's) sentences. This

user seemed to have a good vocabulary. For example, at one point, he wanted to see prompts for the word 'alight'. No prompts were available for this word because no one else previously used it in the reviews. When the investigator explained why no prompts were shown, he moved on to next sentences.

User 1 took a picture of MIT Building 7 entrance and attached with his story. Due to an orientation related bug in the app, the picture was flipped upside down.

Here is the story this user produced:

"We were shocked to say the least. It was a cold Boston day. On arrival at the destination, it made us feel like we were in a deep freezer. Taxis were hard to find. Snow accumulated at the top of the roofs looked dangerous. Because of the storm, there's no parking space. Eventually, we realized it was the worssed (*user typo, 'worst'*) time to visit Boston."
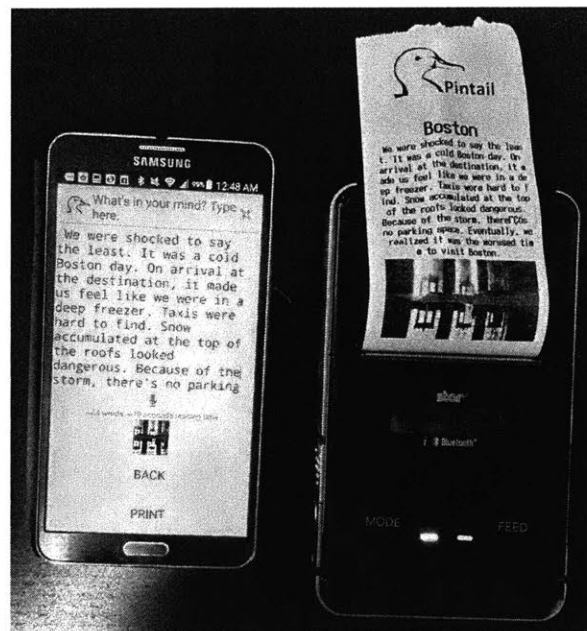
Figure 4-1. Pintailgram created by user 1.

4.3 USER 2: PINTAILGRAM

The second user was a Chicago-native. He was visiting the MIT campus for the weekend along with his son, a high school student. He was interviewed near Kendall Square. For User 2, the prompts were quite distracting. It was distracting to the extent that at one point he chose not to use it at all and just type in the story. For that reason, investigator showed him how to turn off the prompts.

User 2 also stumbled into some serious user experience issues. While User 2 was typing his story, at one point he pressed the 'back' button inadvertently one time too many. Since the session was not saved because of a known bug, he lost his data. He had to start from scratch again.

Here is the story he was finally able to put together:

"This is our second time in Boston. We are here only for the weekend. We are staying at a friend's place near Beacon Hill. We spent some time at Boston Public library this morning. My son particularly liked the Maproom café and the green reading lanterns at the majestic Bates Hall. Now we are heading to the Coop at Harvard square."

There was some difficulty in transferring a picture of Bates Hall from the user's personal cell phone. So the investigator asked him to download a representative picture from the internet and complete his story.

Figure 4-2. Pintailgram created by user 2.

4.4   USER 3: PINTAILGRAM

The third user was recruited at the Logan international airport. He was a first-year undergraduate student of German origin who was new to the Boston area.

Here is the story he created:

"We arrived at the hotel yesterday. We visited Quincy market in the afternoon. Then we went out for dinner at the Palm restaurant. You can get good food there. No tour was available this time of the year. So we were on our own."
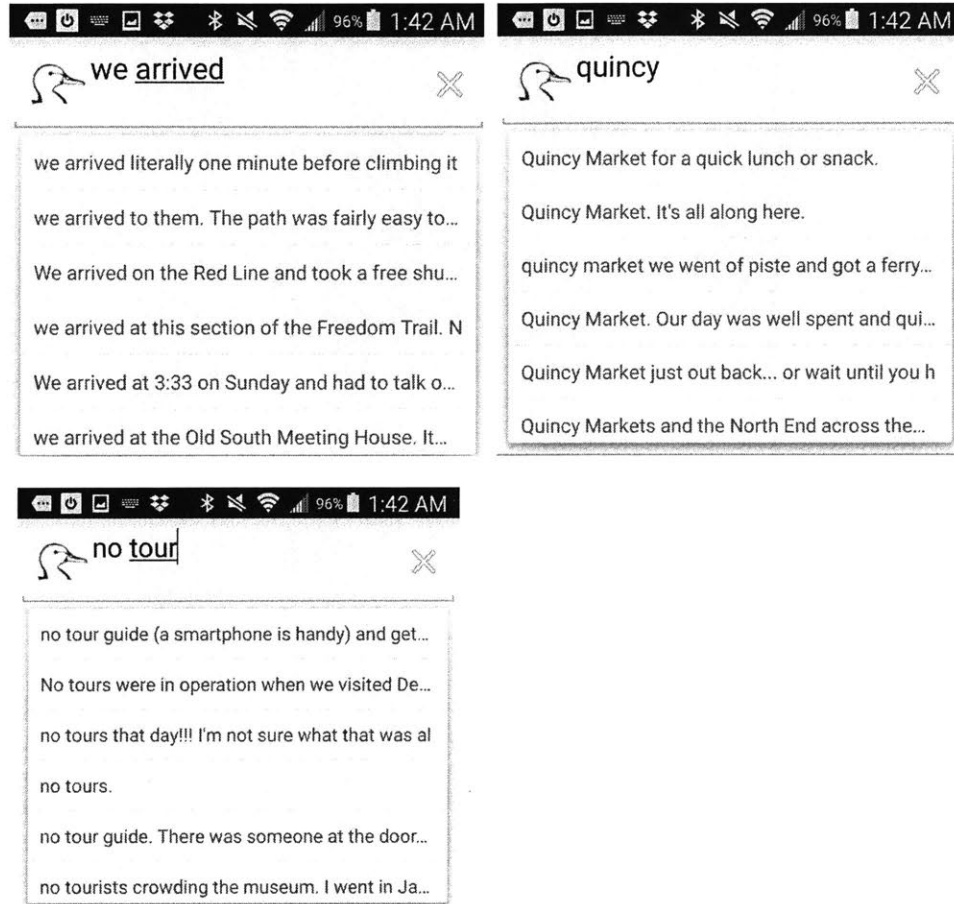
Figure 4-3. Some of the Pintail prompts provided to User 3.

This user seemed indifferent about prompts. Also, there was no review or prompt related to Palm restaurant, which he referred to in his story. That could be one reason why story prompts did not seem to have any visible influence on his story.

We arrived at the hotel yesterday. We visited Quincy market in the afternoon. Then we went out for dinner at the Palm restaurant. You can get good food there. No tour was available this time of the year. So we were on our own.

BACK

ADD DOODLE
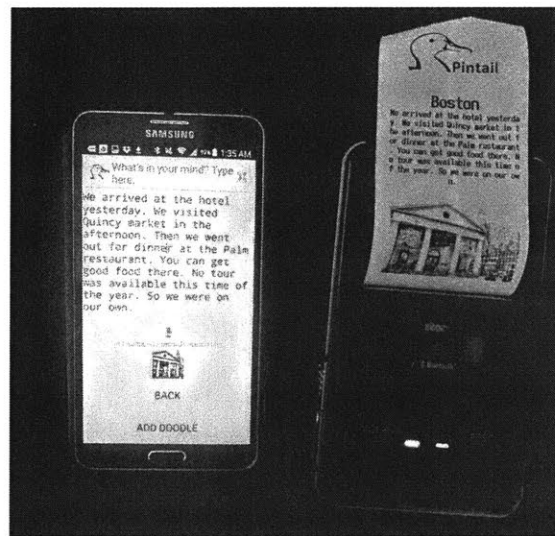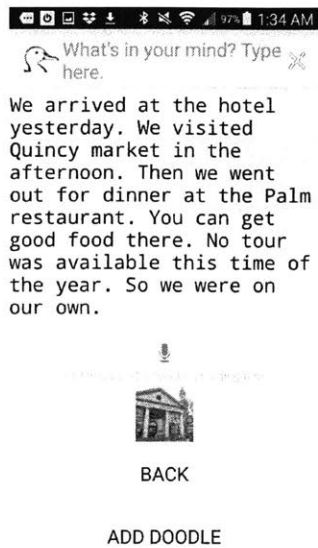
Figure 4-4. Pintailgram created by User 3

4.5   USER 4: DOODLE WITH DOODLE PROMPT

In order to assess the effectiveness of doodle prompts in Pintail Screen and Pintail Slate, two users (user 4 and user 5) were recruited. In the interest of time, they were not tested with Pintailgram. They were also not asked to provide structured feedback using SUS (System Usability Scale) or Product Reaction Cards.

User 4 (female) was recruited from TD Garden as she was waiting for a train. She was not a local, and not new to Boston either. She was asked to draw a doodle on Pintail Slate based on a visible doodle prompt on Pintail Screen.
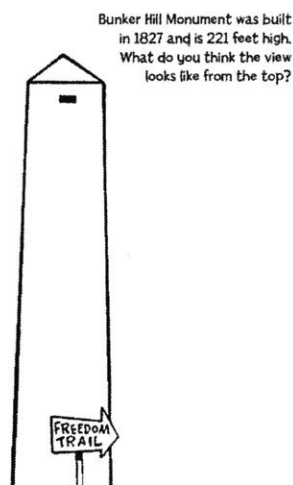
Pintail Screen Prompt: Bunker hill
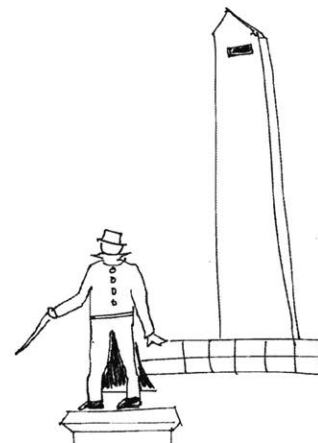
User drawn doodle at Pintail Slate: Bunker hill

Figure 4-5. Doodle prompt provided to User 4 (left)[28], doodle created by User 4 (right)

User 4 did not exactly follow the instruction provided in the prompt. She googled a picture of Bunker Hill. She drew the monument of Bunker Hill along with a statue of Col. William Prescott. The statue was not present in the original prompt.

4.6 USER 5: DOODLE WITHOUT DOODLE PROMPT

User 5 (female) was recruited while she was on board in a commuter train outbound from Boston. She was a student who was visiting her sister in a Boston suburb. She was asked to draw a doodle on Pintail Slate representing one of her Boston stories. She was provided with minimal context and no specific doodle prompt.

Figure 4-6. Doodle created by User 5 without any prompt

The doodle she produced depicted a crowded Boston subway. It was at the top of her mind because her daily commute through T was greatly impacted by the severe winter weather.

4.7 ANALYSIS

4.7.1 Length of story

The stories created by user 1, user 2 and user 3 had a length of 64 words, 66 words and 44 words respectively. Their estimated reading times varied from 13 seconds to 19 seconds.

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[28] Source of doodle prompt: City doodles Boston by Chris Sabatino

4.7.2 Use of prompts in story

Only sentences created by user 1 resembled the syntactic structures of some of the story prompts that were presented to him. It could be because he was genuinely influenced by the prompts, or he was simply provided more guidance by the investigator. For user 2, story prompts had to be turned off because he found it very distracting. User 3 observed story prompts but did not create any story sentence that resembled the prompts.

4.7.3 Desirability from product reaction card

From the product reaction cards in Appendix E, user 1 and user 3 picked both positive and negative words related to the desirability of Pintailgram. User 2 only chose negative words. Based on that, the experience was least desirable to user 2. The reaction keyword 'complex' was chosen by both user 1 and user 3.

Table 4-2. Words selected by users in product reaction cards

User 1		User 2		User 3	
+ve	-ve	+ve	-ve	+ve	-ve
Clean	Complex	x	Distracting	Impressive	Complex
Creative	Inconsistent		Ineffective	Innovative	Time consuming
Helpful			Rigid	Inviting	
Useful					

4.7.4 Usability from SUS Scores

Because of very small number of users, caution should be applied before using any quantitative measure in this user study because the differences are not significant. With that caveat, the SUS (System Usability Scale) usability scores are reported below as a quick and dirty measure for usability. The SUS scores were 72.5, 42.5 and 35 for user 1, user 2 and user 3 respectively[29]. The first score can be interpreted as above average (or 'usable' because it is above 68). Following the same guideline, SUS scores from user 2 and user 3 can be interpreted as below average ('not usable'). SUS is not a diagnostic test, so it cannot pinpoint why the experience was not usable.

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[29] Following https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html

Chapter 5: Conclusion

In this chapter, the limitations, criticism, contributions and future work for Pintail are described.

5.1 LIMITATIONS

The scenario described in Chapter 1 assumed Pintail users will be carrying multiple connected devices. They will be used to switching between those connected devices seamlessly without even blinking. And their sole purpose for carrying and juggling between all those devices will be to work towards a singular goal of passion or a labor of love - telling a travel story. This is a first world problem even by 2050 standards! To our 2015 humans recruited for testing Pintail, it was difficult to describe what Pintail was, what pieces it constituted of, and more importantly, why. Several feet of Boston snow circa February 2015 surely did not help stretching their imagination on how Pintail could be useful to them. They already had enough stories to tell in their existing ways. They did not get super excited about the idea of Pintail telling them how to.

Pintail users suffered from a number of bad user experiences any initial version of functional prototype may come with. For example, one user lost his story when he pressed the back button. He intended to go to the previous screen, but the draft was not saved before screen was switched. As a result, he had to start over again. Another user did not understand why the orientation of picture was incorrect when it was printed. These two were known bugs that were not fixed before taking the prototype to field in the interest of time. Eventually, the user experience suffered.

Pintail's success depended on too many habit changes from the users in a short period of time. Writing a story in the app is different from telling a story in person. The stories created by writing it may not be easy to tell in person. Also, the users did not assimilate the definition of a story in Pintail, since it possibly conflicted with their own definitions. Not all users considered writing or doodling as a form of storytelling either. But they were asked to participate in both as a part of their storytelling exercise.

The time period the users had available for playing with Pintail prototype was not representative of how much time they would ideally take as real users. To test prompt driven stories, the study design ideally needed multiple episodes of testing or multiple interviews spanning the duration of the travel to evaluate the story progress. That could have been possible during summer,. But surely not during February 2015 when the study was conducted because of poor logistics available during back-to-back snowstorms.

Finally, Pintail demonstrates a textbook case of failure in terms of missing deadlines and late delivery due to feature creep. The ongoing expansion or additions of new features late in the development cycle were symptoms of this feature creep, creeping featurism or featuritis. The Pintail developer continued to work on concepts in different directions thinking it was supporting the story-telling use-case. Pintail started with a 'story generator' concept that would generate stories for user. More specifically, this was about generating stories in the form of travel haikus. From travel haiku, it evolved into a web based slideshow like experience called Pintail Scrapbook. After three iterations of Pintail as a story generator for Pintail Scrapbook, this whole track of prototypes was abandoned. Pintail, in its current form, does not generate stories, it only generates prompts for stories. Chapter 2 provides some design justifications on why the concept of generating a prompt for stories is better than generating stories themselves. However, looking back, it can also be concluded that the 'iterations' Pintail went through were not true 'iterations' on the same use-case. Those were examples of being blindsided of the inflation in scope coming in the guise of 'iterations'. Ultimately, Pintail grew to be a much bigger project, for which the implementation became thin in comparison and thus failed to live up to its aspirations. Pintail was not constrained or scoped properly early on. To some extent, this broad scope was by there design to accommodate interesting explorations. The timing of a number of unrelated unfortunate events and circumstances compounded the negative impact of expansion of scope.

5.2 CRITICISM

One criticism of Pintail's current implementation is that it does not have a unified design. One reviewer remarked, "the system seems to be a grab-bag of pieces (a

phone app, a second screen, a third (slate) screen, a printer, etc.). Depending on what the user chooses to do at any given time, some subset of the pieces comes into play."

This criticism naturally poses the question: what was the motivation behind current design? Is the current design better than having something simpler like just a phone and a headset or a watch?

The current design of Pintail prototype was intentionally chosen to be an 'unbundled' experience. It means, for different use cases, the user was expected to interact with different off-the-shelf connected or wearable devices, rather than a single unified design. Here were the motivations behind it:

1. Specialization: Because of the limitation in the 'form', each mobile connected device has a limited function or use case. It is true that a system of connected devices with only a phone and a smart-watch would have been a simpler system. But that simplicity would have come at the cost of cutting off specialized use-cases early on without even exploring them. A unified prototype system would have limited the types of creations or experiences tomorrow's travelers may want to engage with while they are on the go. Those under-served use-cases include doodling about a city (Pintail Slate), printing travel content on the go (Pintail Printer), having an ambient travel related second screen that has more real estate than a watch (Pintail Screen).

2. Loose coupling: Forecasts of wearable devices or Internet of Things devices tend to agree that there will be more mobile connected devices in future[30]. But they disagree on exactly what those devices will be[31]. A unified design would have limited the choices of available mobile devices too early in the design phase. A decoupled user experience helped wider exploration into the design space, by allowing the user to choose which subset of use-cases provided most value given his/ her individual interests.

Looking back, the current design is acceptable only as an early prototype and explorations, but not as a real-world functional system. Depending on the frequency of use, the ideal next step would have been to pick the most widely used use-cases and combine them into a unified system for the sake of simplicity.

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[30] https://www.gartner.com/doc/3778064/forecast-wearable-electronic-devices-worldwide
[31] http://www.wired.co.uk/article/smart-fabrics-beat-smart-devices

5.3 CONTRIBUTIONS

After all the honest confessions on limitations or failures of Pintail, now is the time to make some modest claims. Pintail is the first location based printer ever conceived or implemented. It is not a major contribution but has some interesting potential or UX opportunities if explored further. The form factor and portability of the receipt printer made it convenient to repurpose it as a printer that can be carried between places and repurposing for travel context. The brain or location processor of this location-based printer is still not in the printer itself. The printer needs the mobile phone as its location processor. Bluetooth connectivity is also required to make these two pieces (phone and printer) work together as a single location based printer system.

Next, Pintail Screen demonstrated that a mobile 'second screen' can be used as triggers for content creation. Mobile devices can be notoriously challenging when they are used for content creation. Most mobile phones today have only one screen. Any content or notification or trigger in that primary screen can be deemed as a distraction if those are not aligned to the intent of user in the said context. Second screens do not have this problem. Smart watches already exist as second screens for mobile devices. In addition to smart watches, most mobile phones today come wrapped with a cover, which opens the form-factor opportunity for new second screens. The second screen for phones is ideal for secondary or passive use-cases, such as getting prompts or subliminal inspirations for storytelling. Pintail demonstrated one such use-case.

Pintail is also the first use of travel reviews as story triggers. Until now, travel reviews were only good for consumption, not for creation. Pintail story triggers unlock the content creation opportunities from reviews. Pintail does it first by limiting the consumption, then by enabling scrolling of multiple related review snippets. Pintail expects that such triggers would inspire the user to create stories of their own with minimal cognitive effort.

The story triggers extracted from travel reviews are also a good demonstration of 'knowledge snowballing effect'. The user here starts with a seed. Pintail helps the user first by selecting best set of travel snippets given current context of the user. Additionally, Pintail provides an easy way to sift through multiple travel snippets using real time extraction. If the combination of these succeeds in activating the story-

telling intent of the user, a knowledge snowball (meaning existing seed plus new story) is created.
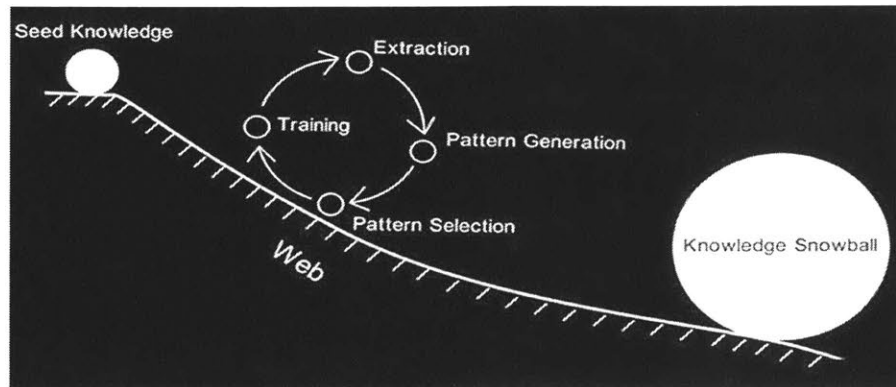
Figure 5-1. Knowledge snowball effect is enabled by Pintail story triggers.

Finally, Pintail optimizes technology use to transform location-based stories into conversation starters. Pintail uses a lot of technologies that are offered by its suite of connected devices. However, the final form of story here is analog. This story or Pintailgram is in the form-factor of a receipt paper. This unique form-factor itself is a conversation starter. Because of its tactile nature, sharing a story has to be in person. One can also create scrapbooks easily by stitching together multiple stories. This form of storing stories is fundamentally a different type of interaction with more personal touch, compared to backing up pictures online or sharing stories in social media.

5.4   FUTURE WORK

Future work for Pintail falls under three categories:

1. *Short-term work:* improve user experience by completing what has already been implemented, mostly by fixing bugs or by making interactions simpler

2. *Medium-term work:* implement items that were part of the vision or original concept but remained unimplemented.

3. *Long-term work:* take design implications from Pintail, and go beyond Pintail

5.4.1   Short term work

All the known issues with user experience needs to be fixed in the short term. That includes preserving story drafts when the user goes back and forth between text and visual based story creation screens. Some of the interactions and configurations today are done manually. There should be clear instructions on what those steps are. That

way the user is guided in the right direction by the user interface. Pintail's makeshift components serve as a good proof of concept but are bad as a final product because of inconsistencies. Those components should speak the same language of interaction.

5.4.2 Medium term work

Pintail can become a better travel companion app by enabling new use cases without having to a lot of work on existing components. It can happen in multiple ways. 'You are here' is a use-case where Pintail Printer detects current location and prints ten things people talk about around here. The selection of these ten snippets will depend upon the user context. For example, the user will see different sets of reviews being selected for the same location depending on the time of the day, time of the year, weather etc. It can generate a static Google map with QR codes for adjacent locations. That will help the user to quickly retrieve directions to her next destination without having to type destination and just by scanning the QR code on Pintail paper. In some ways, Pintail paper will become the disposable location based printed guide-book. It will not be as bulky as the guidebook since it will not contain more than a page of information for current location. It will be disposable because it is printed on receipt paper.
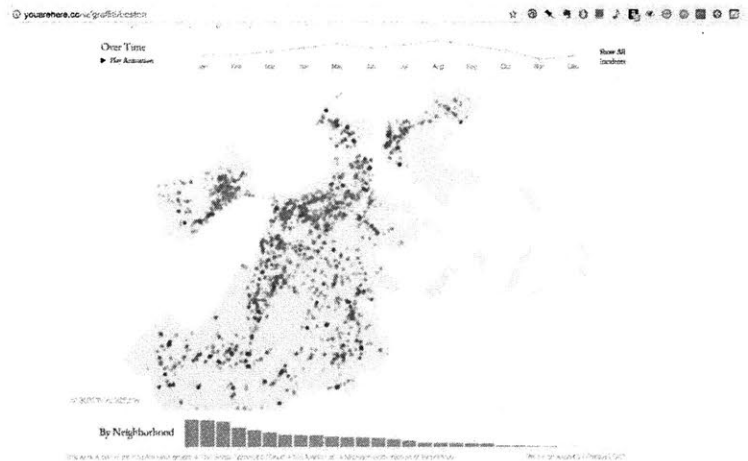

Figure 5-2. Graffiti map of Boston, created by Sep Kamvar and team

Sep Kamvar and team have created a number of maps on different cities based on data from multiple sources. Similar collection for Boston maps[32] can be used for the 'You are here' experience in Pintail. For example: the user can receive a trigger saying that

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[32] http://youarehere.cc/#/maps/by-city/boston

they are in a graffiti-dense location. The user then will be more aware of interesting graffiti's around him, and potentially use them in her stories.

Next use-case is a peer to peer version of Pintail. Pintail, in its current form, is a single user experience. One user cannot send his or her story to another Pintail user. One interesting user experience will be subscribing to all Pintail stories published by friends and family, then automatically print by Pintail Printer just like a morning newspaper. Similar concept was explored by BERG Printer before, except that the BERG printer was not portable nor location based (Hamburger, 2012).

Additional work on the Context engine or State engine will be worth the complexity given its impact on trigger relevance and personalization. 'Context' is something the user is in but does not control. The user moves between different 'states' because of different actions. For example: the fact that the user spent 1+ hour at a location is a state, while the user visits a place on a rainy day is a 'rainy weather' context. Today, Pintail mostly computes the first order of context or state. For example, Pintail can compute 'morning time' context or 'summer season' context from the system time and date. Then Pintail can suggest 'morning' or 'season' as topic seeds if any review about current location matches those strings. These are all first order contexts. Another first order context is weather. If it is raining now, Pintail can check if any review is talking about raining around current location. Now, matching multiple first order contexts simultaneously and filtering reviews based on that would require a second order context engine computation. For example: a 'rainy summer' day context requires a second order computation by the context engine, because it combines weather and season contexts. Second order context is not supported today. In fact, many low hanging first order contexts remain unimplemented today. They should be completed first before delving into second order contexts.

One of Pintail's early prototypes featured an UI element that compressed all locations visited in the last week into five seconds and visualized over a map as a looping GIF. This time compression is a direction that needs to be explored further. Today, due to our short attention span and proliferation of content, we get tuned off easily if a story is too long. Compressed stories can help in that regard. Compression can be achieved in two ways: either by playing the same content at a faster pace. Or by showing fewer content by sampling.

Pintail needs to provide more structured guidance to users on how to stitch multiple stories and synthesize their own. Here are some example instructions for organized paragraph writing (Writing Through the Year: Building Confident Writers One Month at a Time, 1997):

Organized Paragraph Writing

November is a good time to begin working on writing descriptive paragraphs. In addition to writing descriptively, another writing skill students need is how to organize paragraphs with a main idea and appropriate details for nonfiction papers. One of the ways to accomplish both of these goals is with "organized paragraphs."

1. The first step is to think of a topic sentence to use as an example for your class to write about as a group. One I have used before is, "(your town) is a great place to live."

We then write two facts about why it is a great place to live. You should discuss several ideas. You might start the second sentence, "One of the reasons it's a great place to live is . . ." or "Many people think it's a great place to live because . . ." Remember to limit this second sentence to just one idea. Then move on to the second reason why your town is a good place to live.

Review potential beginnings for this second sentence. Some possible ones are, "Another reason people think it's a great place to live is . . ." or "A second reason . . ." You should then have a three-sentence paragraph on the board that may look something like this:

Santa Barbara is a great place to live. I think it's terrific because the climate is mild. Another reason I think it's great is that it has a wonderful area by the beach.
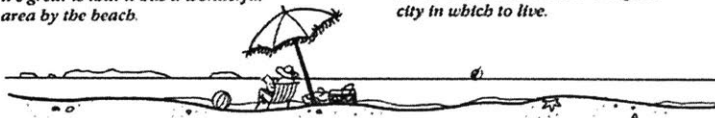
2. At this point you will have a topic sentence and two supporting sentences. The next step is to show the students how to expand the idea. We do this by erasing the last sentence to make room for a detail sentence that expands or explains the second sentence. In the case above, ask how the mild climate is terrific. The answer might be:

Santa Barbara is a great place to live. I think it's terrific because the climate is mild. The mild climate lets us enjoy outdoor activities like running, playing volleyball, rollerblading, and picnicking all year round.

3. Then add the next sentence, the one you had erased, and add a detail sentence to this sentence. The last job is to conclude, that is, to write a sentence that summarizes the paragraph. When finished, the paragraph has a topic sentence, two supporting sentences with detail sentences, and a conclusion. The finished paragraph looks like this.

Santa Barbara is a great place to live. I think it's terrific because the climate is mild. The mild climate lets us enjoy outdoor activities like running, playing volleyball, rollerblading, and picnicking all year round. Another reason I think it's great is that it has a wonderful area by the beach. On Sundays there is an art show there, bicycle riding, and people walking in the sunshine. Yes, Santa Barbara is a great city in which to live.

Figure: Examples of instructions for organized paragraph writing that can be implemented by Pintail as prompts for travel stories

Pintail's current implementation lacks a central store for the Pintailgrams or drafts. Pintail aspired to be the 'commonplace' book for travel storytelling. Commonplace books are books where ideas are stored as draft and iterated on. Ryan Holiday described[33] commonplace books as 'a central resource or depository for ideas, quotes, anecdotes, observations and information you come across during your life and

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[33] From https://thoughtcatalog.com/ryan-holiday/2013/08/how-and-why-to-keep-a-commonplace-book/

didactic pursuits. The purpose of the book is to record and organize these gems for later use in your life'. Similar to commonplace books, Pintail's initial concept included the idea of storing drafts of multiple stories, from which user could later choose and publish one or more as Pintailgrams. The selection of what to publish could be based on the audience, or the mood of the storyteller. The component for storing drafts and content selection remains unimplemented today. However, Pintail continues to take inspiration from the Commonplace books and hopes to build a scrapbook like user experience where multiple Pintailgrams can be stored for storytelling in future.
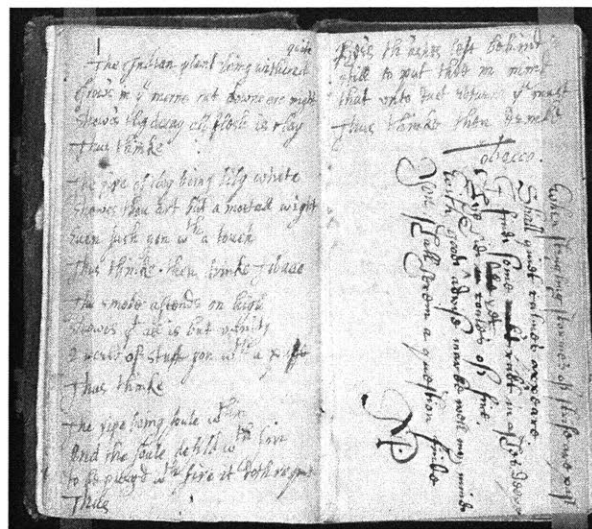
Figure: A commonplace book from the mid-17th century (source: Wikipedia)

5.4.3 Long term work

Long term work in the travel storytelling space will take design implications from Pintail but go beyond Pintail. Described below are some ideas that worked well for Pintail, ideas that did not work and what all these mean for future systems.

Synthesis of story inspirations from user generated content was a great idea and should be explored further. The generated prompts were rich and not repetitive. They unearthed a lot of location specific nuances that would have otherwise remained undiscovered by the user. Future systems should go beyond travel reviews. They should venture into communication data from social media, emails, text or even recorded conversations. Those datasets can then help build a number of computational models. For example: a model for what kind of stories are interesting to the user, a

model for what kind of stories are interesting to the individual audience etc. These models will help synthesis of personalized story inspiration or prompts.

Remixing while creating content was a Pintail user experience that did not work well. Most users found it to be confusing, distracting and complex. Following that, future systems should avoid muddling the creation space with random content from other users. There are two ways to mitigate it in future systems. The story creation user interface can have a clear separation between the creation and the remix areas. Also, the source content for remix should have a common theme or structure, rather than a disconnected burst of snippets.

Analog stories printed on receipt paper came with a novelty factor and a potential for starting conversations. As a travel souvenir or artifact, their life-cycle had some amount of ambiguity. Should they be consumed and thrown away, just like a receipt? Or should they be treasured with care in a travel scrapbook or any other display-able form? Future systems should explore how to increase the perceived value of the analog artifacts that are being produced. It can be achieved by increasing the artistic value of the analog artifact and by making it irreproducible. On the other hand, making the analog artifact reproducible will reinforce the ephemeral attribute and drive ephemeral stories.

5.5   FINAL WORDS

Pintail explores how technology can assist and augment the human pursuit of storytelling. Although Pintail focused on travel context, the ideas presented in this thesis can be used for other forms of storytelling and reminiscence. The idea of taking inspiration from existing stories and synthesizing triggers based on context can be used to augment any task that involves writing. Pintail's principled approach to prioritize creation over consumption and self-limiting over self-reinforcing technologies have broader implications on how we interact with connected devices and ubiquitous technology in future.

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Appendices

APPENDIX A1: SCRAPED REVIEW COUNTS FROM TOP LOCATIONS

Location	Zip	Scraped review count
New England Aquarium	60745	1153
Isabella Stewart Gardner Museum	60745	739
Newbury Street	60745	572
Harvard University	60890	479
Harvard Museum of Natural History	60890	335
Harvard Square	60890	304
Blue Man Group	60745	253
Prudential Center	60745	298
Bunker Hill Monument	60745	244
The Paul Revere House	60745	209
New England Aquarium Whale Watch	60745	220
TD Garden	60745	218
Mapparium	60745	184
Charles River	60890	186
Mt. Auburn Cemetery	60890	165
Franklin Park Zoo	60745	167
MIT Museum	60890	182
Skywalk Observatory	60745	175
The Institute of Contemporary Art	60745	156
Massachusetts Institute of Technology (MIT)	60890	181
Trinity Church	60745	158
Old State House	60745	145
Massachusetts State House	60745	145
Harvard Yard	60890	109
Chinatown	60745	102

APPENDIX A2: TOP 5-GRAMS WITH COUNTS

Feature	Total Hits
is a great place to	262
this is a great	201
in the middle of the	197
my husband and i	154
the freedom trail is	142
a great way to see	139
this is one of the	135
on the freedom trail .	131
if you are in boston	129
is a great way to	129
the museum of fine arts	121
this is a great place	119
this is a must see	114
the freedom trail is a	111
we had a great time	109
the freedom trail .	108
the middle of the city	104
there is so much to	103
to the top of the	101
of the freedom trail .	100

APPENDIX A3: TOP 8-GRAMS WITH COUNTS

Feature	Total Hits
if by land , two if by sea	28
the freedom trail is a great way to	27
one if by land , two if by	25
the freedom trail is a great way	20
'one if by land , two if	19
not a bad seat in the house .	17
freedom trail is a great way to see	16
paul revere's house , the old north	16
Revere's house , the old north church	16
right in the middle of the city .	16
. there is so much to see and	15
this is a great way to see	15
by land , two if by sea äó	15
in the middle of the city .	15
park in the middle of the city .	15
Revere's house and the old north church	15

APPENDIX A4: REVIEW TOPICS WITH COUNTS

Category	Total Hits	Words under Category
DAY	862	Sunday Monday Tuesday Wednesday Thursday Friday Saturday
FEEL	1449	Feel felt
_IS_IT_RECOMMENDED	5540	must see must go do not miss don't forget never miss make sure recommended interested in suitable for next time worth great for should visit should see should go should not
_KIDS_CHILDREN	2913	Kids children
_LOCATIONS	4618	north end freedom trail public garden public library fine arts fenway park MIT Harvard
MONTH	819	January February March April May June July August September

		October
		Movember
		December
_PLANNED	648	planned
		planning
		plan
_REMINISCENT_OF	167	reminded
		reminds
		remind
		reminiscent
SEASONS	1290	_SEASONS_
		summer
		winter
		spring
		monsoon
_TAKE_PHOTO	674	Photo
		pictures
_TIME_OF_DAY	1514	morning
		noon
		evening
		night
_TRAVELING_TOGETHER	525	my wife and
		my husband and
		traveling with
_WEATHER	1282	breeze
		cloudy
		cold
		drizzle
		drizzling
		drizzled
		foggy
		hail
		hot
		rain
		snow
		storm
		sunny
		blizzard
		thunder
		showers
		tornado
		windy

APPENDIX A5: DIFFERENT N-GRAMS UNDER 'FEEL' REVIEW TOPIC

Feature	Total Hits
FEEL	1449
FEEL like	329
i _FEEL_	228
you _FEEL_	153
FEEL the	145
and _FEEL_	105
FEEL of	82
FEEL like you	80
. i _FEEL_	74
we _FEEL_	73
FEEL that	66
you _FEEL_ like	65
FEEL like i	63
i _FEEL_ like	62
can _FEEL_	60
FEEL for	57
it _FEEL_	53
you can _FEEL_	53
FEEL very	49
FEEL it	48
you _FEEL_ like you	48
FEEL .	45
a _FEEL_	45
to _FEEL_	45
can _FEEL_ the	44
FEEL like a	43
FEEL as	42
the _FEEL_	42
FEEL a	41
FEEL like we	39
FEEL of the	39
you can _FEEL_ the	39
FEEL like you are	37
FEEL safe	37
FEEL the history	37
i _FEEL_ like i	37
a _FEEL_ for	35
the _FEEL_ of	35
get a _FEEL_	33
not _FEEL_	33
FEEL like i was	32

APPENDIX B: INTERVIEW PROCEDURE

If you volunteer to participate in this study, we would ask you to do the following things:

Take a short survey; use a mobile app called Pintail and participate in a short interview. The investigator will assist you in installing the Pintail-app in your own mobile or wearable device, or in the device provided by him. During the first operation, you will select the locations of interest in the greater Boston area. After installation, you will continue to use that mobile device as you normally would. From then onwards, Pintail will nudge you with contextual triggers or notifications for adding sentences, image or audio to your trip stories. Following those notifications, or at any time, you can use the Pintail story creation tool for creating stories.

The investigator may accompany you for about one hour near some of your locations of interest to observe contexts of app usage. Or, you may choose to use the app on your own for up to seven days. Interviews will take place at a time of your convenience after app usage and will last less than 30 minutes.

Data will be collected during your use of the Pintail app, including your location while using the app and anything that you input into the app. Only if you consent, your audio, video and photographs might be recorded digitally by the investigator during app usage or during interview.

APPENDIX C: INTERVIEW QUESTIONS

(Before installing the Pintail app)

Subject#

Age:

Gender:

Are you a member of Couchsurfing.org?

How many times have you been to the greater Boston area?

What locations do you plan to visit in the greater Boston area this time?

When you return from a trip, whom do you enjoy sharing your stories with?

Questions to be asked after using the Pintail app for at least one hour:

What did you like about Pintail?

What did you not like about Pintail?

Describe an event when a Pintail notification was interesting.

Describe an event when a Pintail notification was not interesting.

Describe an event when a Pintail notification gave you a story idea.

Describe an event when a Pintail notification interrupted your trip experience.

Have you used the story creation tool?

How many pictures/ audio clips did you have at the scrapbook?

Have you published any story?

How many pictures/ audio clips did you have at the published story?

How easy was it to use the story creation tool?

APPENDIX D: SUS (SYSTEM USABILITY SCALE) FEEDBACK

(After using Pintail)

Please pick the best answer:

	The System Usability Scale Standard Version	Strongly disagree 1	2	3	4	Strongly agree 5
1	I think that I would like to use this system.	O	O	O	O	O
2	I found the system unnecessarily complex.	O	O	O	O	O
3	I thought the system was easy to use.	O	O	O	O	O
4	I think that I would need the support of a technical person to be able to use this system.	O	O	O	O	O
5	I found the various functions in the system were well integrated.	O	O	O	O	O
6	I thought there was too much inconsistency in this system.	O	O	O	O	O
7	I would imagine that most people would learn to use this system very quickly.	O	O	O	O	O
8	I found the system very cumbersome to use.	O	O	O	O	O
9	I felt very confident using the system.	O	O	O	O	O
10	I needed to learn a lot of things before I could get going with this system.	O	O	O	O	O

APPENDIX E: PRODUCT REACTION CARD FEEDBACK

(After using Pintail)
Please pick 3 words that describe Pintail:

The complete set of 118 Product Reaction Cards				
Accessible	Creative	Fast	Meaningful	Slow
Advanced	Customizable	Flexible	Motivating	Sophisticated
Annoying	Cutting edge	Fragile	Not Secure	Stable
Appealing	Dated	Fresh	Not Valuable	Sterile
Approachable	Desirable	Friendly	Novel	Stimulating
Attractive	Difficult	Frustrating	Old	Straight Forward
Boring	Disconnected	Fun	Optimistic	Stressful
Business-like	Disruptive	Gets in the way	Ordinary	Time-consuming
Busy	Distracting	Hard to Use	Organized	Time-Saving
Calm	Dull	Helpful	Overbearing	Too Technical
Clean	Easy to use	High quality	Overwhelming	Trustworthy
Clear	Effective	Impersonal	Patronizing	Unapproachable
Collaborative	Efficient	Impressive	Personal	Unattractive
Comfortable	Effortless	Incomprehensible	Poor quality	Uncontrollable
Compatible	Empowering	Inconsistent	Powerful	Unconventional
Compelling	Energetic	Ineffective	Predictable	Understandable
Complex	Engaging	Innovative	Professional	Undesirable
Comprehensive	Entertaining	Inspiring	Relevant	Unpredictable
Confident	Enthusiastic	Integrated	Reliable	Unrefined
Confusing	Essential	Intimidating	Responsive	Usable
Connected	Exceptional	Intuitive	Rigid	Useful
Consistent	Exciting	Inviting	Satisfying	Valuable
Controllable	Expected	Irrelevant	Secure	
Convenient	Familiar	Low Maintenance	Simplistic	