Quologue: Supporting Reflective Experiences with Personal E-book Data Through Generative AI as a Lens

by

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Abstract

People can highlight text on e-books using various devices, generating metadata that captures and stores passages of interest in digital archives. However, the lack of a physical presence makes e-books less visible in daily life, affecting how people rarely reread their e-books. In this thesis, I detail a research project that involved two distinct stages related to Quologue, a web application that uses e-book metadata as a resource to revisit their e-book archive. By making metadata more interactive and integrating it with generative AI, the research aims to foster a reflective meaning-making experience. First, I reflect on three design events to illustrate alternative interactions with e-book metadata and highlight the opportunities and challenges of using generative AI as a design material. Second, I analyze findings from an eight-week field study that explores the reflective potential of personal e-book metadata and uncovers opportunities and tensions in re-experiencing metadata archives through generative AI.

Keywords: e-book metadata; generative AI; large language model; interaction design; design research; slow technology

In loving memory of Halmoni, my grandmother

Whichever road I take, I promise to be your bird

To see, to feel, to hear, to wonder, and to live, to live.

Leaving no life unlived

Until we meet again

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On a personal note, over the course of my experiences so far, I feel the need to say that I have learned more about life and myself from my dearest friends than in books. First, I want to thank Yelim who I had a chance to share our precious time in undergrad. The times I spent with her taught me that the most beautiful impressions and feelings feed the innermost corners of our heart. One particular day comes to mind. It was in the summer of 2020 during COVID. We had a cozy lunch with just the two of us at her apartment. After lunch, she was washing the dishes, and I took a picture of her with a ray of sunlight coming through the slightly open window, letting in the hot summer air that smelled like candy—a day that would make a perfect pairing with Bach's "Sheep May Safely Graze." Moments like this left an impression on me that still has an effect like a very pleasant dream. During the most difficult times of uncertainty, those memories come to me, which presented themselves as nothing particularly important at that time. I thank her for being a part of my life who brings so much love and many laughs.

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Growing up, gazing at the sea from my hometown filled me with so much hope. I can't say for certain to what extent living near the seascape has shaped who I am, but I believe it surely made me a lover of metaphors about the sea. They remind me where I come from. I conclude with this quote:

"There are times when you have to leave the port even if you leave behind what is most important to you." – The Square by Choi In-Hun

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List of Acronyms

AI	Artificial intelligence
GAI	Generative AI
HCI	Human-computer interaction
LLM	Large language model
RtD	Research-through-Design

Chapter 1.

Introduction

Books and the everyday practice of reading have played important roles in people's lives, enabling a wide range of experiences, including personal growth [72], knowledge acquisition [16], identity construction [22, 56], and ways of socially connecting to others [120]. To further engage with books, people make annotations (e.g., highlights, making notes in the margins) to mark ideas that they may find personally significant, confusing, or to indicate agreement or disagreement [112]. Annotations also serve as a tool to show one's ownership of the book or to pace one's reading speed by slowing down to log a reflective annotation [40]. With the rise of electronic books (e-books), reading text and annotating through digital media is becoming increasingly more convenient with new technologies such as mobile devices, e-readers, e-ink, and e-reading platforms like Amazon Kindle [79]. It is projected that over one billion people will be reading e-books by 2027 [148]. There are e-book reading platforms on the market (e.g., Kindle, Kobo) that simulate annotative features that involve creating highlights, margin notes, and bookmarks. These traces people make on e-books are then recorded in digital archives as metadata, providing people with precise histories of their annotative reading practices with books. Considering that people often choose e-reading for these convenient features which print books cannot afford [58], digital annotations can be fascinating sources of personal data, especially for avid e-book readers.

However, unlike print books, which occupy visible spaces in people's homes and prompt them to be casually revisited over time [50], e-books largely do not occupy a physical space, remaining largely invisible in everyday life. As e-books continue to gain traction, the growing archives of e-books and readers' interactions with them pose new issues and opportunities for the HCI community. When these e-book archives grow larger, it becomes increasingly difficult to grasp how big one's archive is and the memories, associations, and emotions that might be bound up in these digital traces [99]. This tension can create barriers for e-book readers to revisit these potentially valuable resources that are tied with readers' past thoughts, emotions, experiences, and reminders for future actions [111]. Yet, there is limited knowledge on strategies and concepts that could inform how we can promote reflective or self-expressive experiences

with e-book metadata. In parallel, there is an ongoing concern in the HCI community to develop new alternative approaches for people to experience their personal data in more creative, expressive, and open-ended ways [19, 29, 31, 74, 90, 135]. However, examples illustrating how such engagements with personal e-book data can be mediated through the creation and study of new design artifacts remains underexplored in the HCI community.

In building these new design artifacts, generative AI (GAI) can be a powerful tool to mobilize personal text data, such as one's e-book highlights, from conventional data archives into materials for more conversational interactions. As more HCI researchers are exploring the potentials of GAI for personalizing user experiences [71] and enabling meaning-making with personal data [6, 133], it is timely to consider new ways of revisiting one's personal metadata through personalized experiences.

In previous HCI studies, randomness has been used as an effective resource for creating engaging experiences with large personal digital archives, (e.g., *Olly* [96], *Photobox* [93], *Reflexive Printer* [127]). GAI also relies on non-deterministic processes, and, as Benjamin et al. [5] argue, the unpredictability of GAI can be leveraged as a design resource to engage with personal data. GAI, however, can also take direct input [85] from the user, which can then influence what is generated by the system. For instance, large language models (LLM), which are GAI models that are pretrained on substantial amounts of textual data, can take in an input text and generate an output text that is likely to follow the input text based on probabilities [66]. Many LLMs such as GPT models [149] , BARD [107], and MPT-7B [150] can execute this through multi-turn conversational interactions. By building an LLM system that takes in one's own text-based e-book metadata, a user could potentially have dialogue-like interactions with their own metadata and creatively produce new data—in effect, extending beyond simply revisiting randomly selected past instances in one's personal archive. The interactive quality of GAI has been explored in the context of self-reflection [12, 13] and co-creation [21, 122]; however, using GAI for navigating digital archives remains an emerging and underexplored design space. With the growing use of e-books, and the rapid acceleration of the development and integration of GAI into daily life (c.f., [85]), it is timely to consider how GAI can be harnessed as a lens to revisit personal e-book metadata archives, which can contain valuable records of one's past but is limited in its current interactivity. To investigate this, it is worthwhile to first examine the potential of e-

book metadata and GAI as design resources for creative self-expression. The insights from this exploration could then drive the building of a new GAI infrastructure that facilitates one's engagement with e-book metadata. Lastly, one can investigate how this infrastructure could influence other people's interactions with their own e-book metadata and e-reading experiences.

In this thesis, I present my twofold research process to explore this design space. The first stage (Chapter 3) focuses on investigating the potentials of e-book metadata and GAI as design resources for creative self-expression. This stage investigates the following research questions:

- How can an archive of e-book highlights serve as a resource for creative expression and self-reflection?
- What opportunities, challenges, and tensions might emerge from working with generative AI as a design material for e-book highlights?

To pursue these questions and ground my own thinking in this emerging space, I adopted a research-through-design approach [41, 47, 145] to design and build Quologue—a web application that allow users to express themselves by using their own past highlights on e-books as a resource. Each week, Quologue surfaces three keywords that are generated by thematically analyzing a randomly selected highlight from users' archives. Upon first viewing, Quologue does not reveal any other contextual clues such as the complete quote, the title of the book, or the name of the author. With only the abstract pieces of their past highlight, users are invited to interpret in their own subjective ways by writing a short reflection over the course of the week. When users complete and submit their reflection, Quologue remixes their reflection with the original quote where the keywords are selected from. This remix serves as an output of users' creative self-expression that takes their own past metadata as materials. Over time, these remixes are accumulated in the archive, gradually transforming their e-book highlights archive into an archive of creative self-expression.

The objective for the first stage of the study is not to elucidate every decision I made during the design process of Quologue nor present Quologue as a finished artifact. Instead, I report and discuss findings from three key frictions (or "design events" [102]) that took place in the early stage of the design process that involved exploring

with GAI and e-book metadata and living with the prototype. Next, I interpret implications emerging from my design research process for future HCI research and practice.

The second stage (Chapter 4) discusses my research process and findings from the deployment of Quologue. This stage investigates the following research questions:

- How can making e-book metadata more interactive and mutable for data owners shed light on new possibilities for memory-oriented interactions with personal data?
- How can ambiguity in AI-generated content derived from personal data be leveraged as a resource for engaging with one's digital archive in a valuable way?
- In what ways can surfacing one's digital traces on e-books influence people's awareness of their own personal data and their digital reading practices?

I conducted an eight-week field study and deployed Quologue to 10 participants to open a dialogue with participants about the reflective and self-expressive potentialities of personal e-book metadata; and to learn about any opportunities and tensions that emerge from co-evolving one's metadata archive with a GAI model.

Through this research project that involved designing and deploying Quologue, I make following contributions to the HCI research community and design practitioners.

First, I contribute to a nascent design space of using personal metadata archives for creative expression and self-reflection. Second, I illustrate how the design of a GAI system can help people uncover new ways of making use of their own personal data over time. Third, I offer insights on designing alternative forms of incorporating GAI in a system to encourage open-ended interpretations. Fourth, I analyze the ways in which living with this new type of GAI system for personal e-book data have influenced people's current digital reading practice and helped envision future potentialities of their data and practice.

1.1. Overview of chapters

In Chapter 2, I present the literature review of related works. It includes reading practices through different media, supporting self-reflection through personal data, harnessing AI

for open-ended reflective experiences and applying an autobiographical design approach in HCI.

Chapter 3 is devoted to the first phase of this research project. I explain my design research process from preparing my data to building and living with the prototype system of Quologue. Then, I outline key design events from working with GAI and e-book data. I conclude with the discussion points on defamiliarizing metadata archives and dealing with a dynamic relationship with GAI as a design material.

Chapter 4 is devoted to the second phase of this research project. I start by discussing the design process and rationale of a refined version of Quologue after the conclusion of the first phase. This is followed by the details on the deployment of Quologue. I present the findings from participants' accounts of living with Quologue and discuss implications for future HCI research and design practice.

In Chapter 5, I conclude this thesis by reflecting on the research questions and the contributions.

Chapter 2.

Background & Related Work

2.1. Reading practices through different media

The popularization of e-books and e-book platforms have enabled people to have access to their collection of books from anywhere as long as they carry their e-reader or other portable devices. Despite this advantage, many people still choose paper as a medium for their reading [7, 63, 86, 116]. Scholars have conflicting views on which factors influence people's decision of the reading medium, and a consensus has not been established yet. In addition to demographical factors such as gender [4, 14] or age [3, 17, 125], some studies also suggest that the genre of books plays a key role in determining the preferred reading medium. People prefer paper books when they are reading literary classics [73, 117] or academic materials [116], whereas, people are more likely to choose e-books when they are reading light fiction such as fantasy or crime novels [73].

Gruning [50], on the other hand, sheds light on the nuanced motivations behind choosing a reading medium by positing that the motivations are shaped by factors such as anticipation for future uses and identity. For instance, if people anticipate that they will be visiting the book again after the first reading, they prefer to purchase paper books. Also, since paper books can be displayed in the owner's domestic spaces, the paper books that one owns could function as a means of reinforcing one's personal identity while signaling this to others. In contrast, Gruning notes that the lack of a material presence makes e-books less visible in everyday life, affecting how people rarely reread their e-books and value them.

When e-books are favored, people are often drawn due to a faculty of the unique digital features where physical books fall short. Hupfeld et al. [58] point out the compromises people make when choosing which medium to read on. E-books offer notable affordances such as the ability to carry large volumes of text, to integrate with digital elements (e.g., embedded links), and to access them easily regardless of location. These affordances can make e-reading more attractive to people; however, even with these advances, there are limitations in e-reading infrastructure that restrict user's

interactions with text. When people make annotations on e-books, e-reading applications can restrict readers' ability to express their intent in highlighting and annotating, e.g., "forcing a highlight to be continuous when the reader wants to fragment it, or imposing neatness on a reader when she wants to scrawl" [79].

Additionally, many e-reading platforms restrict users' freedom to manipulate or interact with their data stored within their system such as not supporting features for exporting their annotations [67]. In the case of Kindle, users' comprehensive history of highlights from all books is stored in a separate text file named "My Clippings.txt," which can only be accessed by connecting their Kindle to a computer and navigating through the file directory to locate it. Even with this method, this text file is written in a distinct format, creating barriers for lay users to engage with their data. When this type of data is collected and controlled by proprietary infrastructure, it can "appear to be uncontestable, or natural parts of the world," [45] making it difficult to imagine an alternate form of the technology as documented in my previous work where I went through the process of extracting and repurposing e-book data stored and controlled by an e-reading application [67].

In summary, prior research shows that a variety of factors contribute to people's decision-making process in selecting their reading medium. When it comes to rereading, e-books are lacking in their affordance to make people revisit what they have read since they are kept in digital space. Also, e-reading platforms are often limited in features that help users engage with their annotations. Yet, few works have attempted to extend the affordance of e-books by exploring e-book highlights as a gateway for revisiting what they have read.

I aim to address this research gap by making e-book users' metadata more interactive and introducing new affordances to the system by integrating it with GAI to promote an engaging meaning-making experience with their e-books. I also investigate the effect of living with this GAI system on people's perception of their reading practice and digital e-book archives, which have largely been forgotten or absent in their daily life and routine.

2.2. Supporting self-reflection through personal data

Data acts as a powerful tool that guides our views, decisions, actions, and many areas of modern-day living. The Quantified Self movement exemplifies an attempt to understand ourselves through numerical representations and models of ourselves and the world [34, 114]. Prior design research studies have also started to explore alternative ways of experiencing or reformulating personal data, e.g., home IoT data and somatic data. For instance, Desjardins & Biggs' Data Epics [28] challenge the conventional idea of home IoT data as precise numerical representations of dwellers' activities or their spaces, instead envisioning how home IoT data can be repackaged and consumed as fiction works. Helms also sheds light on designing for actions involving human waste, e.g., urination, problematizing how physiological urges and actions are controlled by technologies that track one's somatic data.

Personal data can also be recorded in the form of metadata, the history of our interactions with many digital systems we encounter in everyday life. Personal metadata, capturing aspects of our temporal life, have the capacity to represent elements of people's personality, identity, and emotional experiences [65, 101]. However, HCI researchers have raised concerns about the storage of these potentially valuable traces in extensive digital archives that remain invisible in people's daily life, contributing to limited understanding and control of their digital footprint [90, 99]. Many HCI scholars have suggested various productive applications of personal metadata, including using metadata as a resource to empower people's ability to manipulate and customize their digital possessions [99] and to encourage the data owners' meaning-making experiences to highlight its reflective potentials [52]. This approach aligns with a growing interest in designing technologies that go beyond short-term functional utility to foster deeper user engagement and reflection.

In Hallnäs and Redström's seminal proposal of slow technology, they call for design practice that conceptualizes technologies as entities "that surrounds us and is part of our activities over longer periods of time" [53]. This paradigm of slow technology also challenges the dominant HCI tradition of designing technologies for the value of optimizing performances and instead advocates technologies that create moments of self-reflections or critical reflections towards technologies [92]. A variety of research artifacts have been designed and built to invite users to actively slow down and reflect

on their rapidly accumulating data. These artifacts explore the uses of different personal data, including music (c.f., Olly, Olo Radio, & Musée) [61, 90, 96], photos (c.f., Capra [97], PhotoClock [19],), location histories (c.f., Memory Tracer & Memory Compass [135]). These efforts collectively embody human-data relations that evolve with users over time and support rich reflections. Notably, there have been more attempts in recent years to give users a degree of freedom and agency in controlling the pacing of the system, such as PhotoClock [19], Chronoscope [20], and CrescendoMessage [126]. These new research artifacts exemplify that the theory of slow technology is not restricted to promoting temporal "slowness" by limiting almost all user control on the pacing of the system, and the concept of "slowness" may extend to new dimensions [92].

It is also worth noting that while these slow technology artifacts surface valuable past digital traces from their archives, they have not yet ventured into using these metadata as materials to give users creative control on generating and feeding new data into the system as a means of self-reflection. This presents an interesting area of research since creative writing, in particular, has been acknowledged as an effective way to support self-reflection [37, 113]. Scholars have examined the role of creative writing in navigating personal emotions that may be hard to articulate or define otherwise [68] or helping reflections on one's professional practice, offering a unique avenue for insights and growth [60].

In my work, I incorporate creative writing practice into a slow technology artifact by using traces of people's past reading experiences as materials for writing. I aim to contribute to the ongoing research by exploring the potential of using personal e-book metadata, a source of personal data that has not received much attention within the slow technology paradigm. I examine the potential role of this text-based data in allowing users to co-create new data at the present moment of interacting with a system in addition to simply surfacing past digital traces.

2.3. Harnessing AI for open-ended reflective experiences

As the complexity of AI systems has grown extensively in recent years, research in explainable AI have pointed out the need for making the inner workings of AI systems more transparent and manageable by end users [75, 76]. These works are potentially valuable for enhancing trust and transparency in various context, including providing

support for coding [123] and medical decision making [134]. On the other hand, there is an emerging body of work that views uncertainty in AI technologies as a design resource. For instance, Benjamin et al. [5] point out that some degree of uncertainty is inherently engrained in the nature of these technologies, and this uncertainty arises from their attempts in simulating real-world phenomena and the presence of noise in the data used to train the models. Their work presents concepts for harnessing this uncertainty as a design material, highlighting the dynamic potentials of AI technologies, such as machine learning predictions, in shaping human-world relations.

More specifically, HCI scholars have started to explore the role of AI in mediating reflective experiences on broader aspects of one's personal life through interacting with the data they collect or produce. Brand et al. [12] focus on the action of introspection, which refers to reflecting on one's inner self, to examine the ways various kinds of personal data can mediate this experience when powered by AI. They present various design concepts, e.g., supporting collaboration and alignment, encouraging confrontation and critical reflection, to reimagine the action of introspection with the help of AI. Lo [77] has documented her experiences of introspection regarding public identity and societal biases through training a custom language model by feeding in personal data from their LinkedIn resume and engineering prompts for interactions. This exploration shows how AI can be leveraged to encourage critical reflection through personalized content generation. Additionally, in Burg et al.'s work [128], they argue that the experiences of self-reflection were not restricted to interactions with the final outputs of the AI model. Instead, they occur throughout the data preparation process, as they engaged in self- reflection while annotating the data that they have collected. Collectively, these works exemplify the potential impact of using AI on the broader scope of our lives that extends beyond direct interactions with AI.

Among a wide range of AI technologies, in recent years, large language models (LLMs), in particular, have been the focus of many HCI researchers due to the proliferation of commercially available LLMs such as GPT models [149] and BARD [108]. LLMs refer to a subset of GAI models that are pretrained on substantial amounts of textual data. Since they are probabilistic models, they can take in the same input text and yield multiple different outputs. For lay users who are non-AI experts, it can be relatively easy to manipulate through natural language, thereby lowering the barrier for them to create high-quality prototypes that produce semantically engaging text output

through multi-turn conversational interactions [38]. Basic capabilities for a single run of LLMs span from categorizing or rewriting the input to generating a list of examples or a creative hallucination [139].

While LLM systems have often been implemented in the form of chatbots [1, 77] to encourage open-ended reflection, investigating more subtle ways of incorporating LLMs is underexplored in HCI. Rajcic & McCormack [109], for instance, built a table lamp that listens to people's conversations throughout the day and generates a poem based on the keywords drawn from the collected data. They explore how LLMs could co-inhabit a domestic space while encouraging open-ended reflections through daily rituals, e.g., having conversations, reading the poem, and reflecting on the poem. Based on this it is possible to envision a possible future where LLMs have become seamlessly integrated into our daily lives and support our everyday routine. However, it is worth pointing out that, for the input into their table lamp, the they make use of the inhabitants' conversations only from the previous day. Also, this lamp is not equipped with features that allow users to have some degree of direct creative control over the generated output, while users may still indirectly influence the input by being aware of this lamp during conversations.

Considering these points, to harness the generative power of LLMs to encourage open-ended reflection on personal history, it may be valuable to build LLM systems that make use of a wider timeframe of one's past. In my work, I explore personal e-book metadata archives as a potentially valuable source of input for LLM systems, which store rich records of our digital past on e-books. Additionally, I aim to design an LLM system that balances the subtlety in promoting user engagement while including ways for users to exercise some degree of direct creative control.

2.4. Autobiographical design in HCI

2.4.1. Autobiographical design as a first-person research approach

According to Desjardins et al. [33], first-person research methods were originally employed in social sciences to challenge the so-called "objective" research methods and emphasize one's personal voice in academic writing. The researchers further characterize the first-person perspective by drawing a distinction from other

perspectives, namely second-person and third-person based on the scope of design projects. In HCI, first-person research methods could involve ideating, fast tinkering, role-playing in early prototypes, and testing through self-usage, and they allow researchers to get a glimpse of their events intertwined with cognitive experiences. If a study takes on a second-person perspective, it could involve a designer acting as a facilitator in co-design sessions or workshops that involve multiple actors in a given design context. In the case of the third-person perspective, it puts an emphasis on providing descriptions of natural events that are not centered around one person's narrative. Based on this distinction, they argue that when you design for yourself (first-person), the study would be autobiographical while designing for society is third-person, and designing for a smaller part of society represents a second-person perspective.

Autobiographical design is a prime example of a first-person research method, and it refers to a research method that actively incorporates personal experiences and reflections in a design process instead of disregarding them. Neustaedter & Sengers [88] provide an in-depth overview of the opportunities and limitations of the autobiographical design method after interviewing 20 HCI researchers. The researchers highlight that, in an autobiographical design study, it is crucial for researchers to have genuine needs for some artifact or system and live with their design over an extended period of self-usage. This helps researchers develop their own deep personal understanding of the design context. Also, since the process is self-guided, researchers are able to iterate on their design more efficiently and move fast, which can be especially beneficial if the design is an early-stage exploration. The researchers, however, highlight that the findings from an autobiographical design study do not generalize to a broader audience due to its initial scope. To evaluate an autobiographical design study, one could instead focus on the quality of researchers' reflection of their processes, which could include their design motives, expected outcomes, implications of their design, etc.

Neustaedter & Sengers's study [88] provides a theoretical basis for future studies on autobiographical design. Desjardins & Ball [27], for instance, use the study as a lens to critically analyze six previous autobiographical design studies, including two from their own. They report that the "needs" in autobiographical design projects are often multifaceted since they could mean various things such as "goals, motivations, curiosities, or interests for a design." Also, it is possible to have other actors entangled with an autobiographical design process. When people are involved in designing and

living with an artifact, this leads to an issue of addressing researchers themselves in academic papers, i.e., whether to use the pronoun “I” or “we.” By revealing these tensions in autobiographical design studies, the researchers build on Neustaedter & Sengers’s work [88]. They also offer nuanced views on recommendations for autobiographical design studies. To illustrate, researchers need to be transparent in their “genuine need” for a proposed design, and attending to the perspectives of other people involved in a design context could lead to discovering interesting insights.

Boehner et al. [9] use the autobiographical design method to build an artifact that communicates one’s mood in an open-ended way. The research artifact Affector is a wall-mounted display placed between the office spaces of two authors, and it displays a video of the person on the other side of the wall taken from a camera while distorting it in a way that communicates the other’s mood. However, unlike many existing affective computing systems, there is no explicit fixed mapping between distortions of one’s images and their mood, and the mappings can be customized by the users. During a focus group session, the researchers reflected that while using Affector, they had become more interested in “inducing emotion” rather than “expression emotion,” which contributed to establishing a bond between the two researchers through “fleeting, emotionally evocative hints.” This reveals a subtle shift from their original intent of designing the artifact after living with it and engaging in open-ended reflection for two years. As this work shows, autobiographical design as a method could allow researchers to capture nuances in highly personal experiences with an artifact or a system, which can be used to drive further design explorations.

In another paper, they reflect on their experience of creating Affector and characterize it as an affective presence system that refers to a system that focuses on promoting reflection on “enigmatic experiences of affect” instead of pigeonholing emotional experiences [118]. Drawing from their research process, the researchers present several strategies for designing affective presence systems:

- **Varying system control**: For people to engage in a more liberal meaning-making process, systems could 1) avoid establishing (or revealing too much of) mappings for meaning or 2) allow users to reconfigure their systems based on their wants and needs.
- **Defamiliarization**: exaggerating and minimizing information can provoke users’ interpretation and reflection

- **Digital scaffolding**: Designers should be cautious of making the system too incomprehensible to users. One way to prevent this is to communicate with familiar contexts to users.

These strategies highlight the importance of maintaining the balance between letting users engage in a liberal meaning-making process and preventing the system from being too incomprehensible in artifacts or systems that emphasize users' interpretation of them.

As studies on Affector [9, 118] reveal, an autobiographical design approach can be valuable for affective presence systems, as it allows designers to put an emphasis on first-hand experiences that are associated with personal significance and emotions. In the case of an LLM system that uses personal metadata and encourages open-ended reflection, researchers could also take on an autobiographical design approach to obtain rich data on one's own meaning-making process surrounding the system. For the rigor of this kind of study, the same set of criteria for evaluating autobiographical design studies would also be applicable, including documenting one's design motivation and decisions.

2.4.2. Autobiographical design & Research-through-design

Research-through-design (RtD) methodology was developed to reframe problems and provoke discussions through the act of designing instead of offering immediate solutions to a problem [147]. As it emphasizes documenting one's design process, when it is combined with an autobiographical design method, it is possible to get rich data on one's design motivation and reflections on designing and living with their artifact. This subsection showcases studies that exemplify this aspect.

Ciobanu & Juhlin [23] investigate how humans can be more attuned to changes in nature over time by creating a physical prototype that tracks changes in a physical environment through four different sensor data (light, temperature, humidity, and soil moisture) when a user is walking. The researchers were able to discover fascinating insights from the first-hand account of developing and living with this prototype. For instance, they mention that the first author was able to notice changes happening in their environment, including both technology-mediated and non-mediated ones. There was also tension between carrying out human clock-based tasks while trying to attune to the temporal changes in nature.

This particular combination of research methods was also used to study how to maintain bonds with close relations that have deceased. Wallace had a personal need to keep her connection with her deceased mother and used a photo archive of her mother to develop ReFind: a handheld device that surfaces photos from their photo archives that are relevant to a user's current life events [132]. ReFind can take input from the user who can post photos from recent events and use the semantic metadata of the photos in the archive to display the ones relevant to the user. In the findings, the authors elucidate on the nuances of how the first author interacted with ReFind. For instance, Wallace reports the differences of feeling connected "to" and "with" through ReFind. She describes the act of posting photos as sending them "to" her deceased mother, which is a one-way interaction; however, in some cases, she would feel the need to connect "with" her mother. This need prompted her to carefully select a set of photos that could make the engagement with ReFind more interactive and meaningful. In this study, it is possible to see that Wallace had a genuine need to connect with her mother, and through the self-use of ReFind, she was able to get rich data of personal reflections with nuances that could be overlooked in other research methods.

In designing an LLM system that makes use of one's personal data, a research method that combines a research-through-design and an autobiographical design approach could be fascinating. Personal metadata are deeply associated with personal memories and experiences, and instead of looking to generalize one's personal accounts, researchers could augment their first-person voice in designing and living with these systems. In addition to having detailed accounts of first-person experiences in the process, they could also explore an alternative future where people take on a more active role in managing and manipulating their own metadata.

2.4.3. Autobiographical design approach for designing with large language models

As mentioned in earlier in this chapter, most LLM systems built for research studies take direct input from users under a short timeframe. The interfaces of these systems (e.g., *PromptMaker* [62] and *PromptBoard* [39]) that facilitate prompt engineering contain a textbox where users can manually type in their prompt, often impromptu. This way of taking text input is commonplace for GAI products in the market as well, such as ChatGPT [103], DALL-E [104], and Code Llama [83]. Rajcic & McCormack's LLM-

integrated table lamp [110], on the other hand, takes input indirectly by listening to people's conversations for a day; however, it shares the issue of many LLM systems that the timeframe of its input remains relatively short.

To address this research gap, researchers could harness personal metadata archives as potential sources of input for LLM systems. Since these archives store people's digital traces, they could potentially provide rich information about people's lives that spans over a longer period of time for LLM systems without having the need for people to manually type it in. Previous HCI studies have explored the design opportunity of using personal metadata as a design material to encourage people to reflect on their past and technology in the case of music listening [90, 95], location histories [136], and photo archives [19, 91].

However, the generative power of LLMs opens a new avenue for engaging with our metadata. LLMs enable us to generate secondary content based on one's metadata with minimal effort on the users' end. This poses an interesting area for further study that is distinct from other previous works that have explored metadata as a design material. Under this paradigm, users would be revisiting one's past metadata while generating new data simultaneously. To speculate on this, an LLM system could identify overarching themes in one's highlights that could potentially help people engage in self-reflection. They could also prompt the system to select a highlight from their archive based on their current interest and have an interactive dialogue with the highlight.

These explorations would also further extend Rajcic & McCormack's work [110] on using an LLM system for open-ended reflection. By bringing digital traces from their archives to the surface, researchers could investigate the role of LLMs in mediating reflection on a more distant past. Our past digital records, compared to their physical equivalents, are often perceived as being stored in a "placeless" digital space that discourages people from further interacting with it [100], though users themselves are responsible for producing these.

To challenge the status quo of how metadata are consumed by people, it would be valuable to use a research method that combines research-through-design and autobiographical design. A research-through-design approach would help researchers imagine and explore an alternative vision that personal metadata could be returned to

original owners as materials for creative expression. Users formerly take on a more passive role in their interaction with digital systems, where their actions are being recorded and stored; however, the act of using personal metadata as design materials for creative self-expression can problematize this practice and offer a glimpse into a way of reclaiming our own data, which could deconstruct the dichotomy between data consumers and data producers.

An autobiographical design approach, on the other hand, could potentially uncover nuanced changes in the way our practice is affected by technology. As Desjardins et al. [27] argue, one's "genuine needs" in autobiographical design studies can be more multifaceted at a closer look. If we were to incorporate an LLM system into our practice of reading e-books, this new concept of consuming and reproducing text through e-books could change the way we read e-books and annotate. For this reason, it would be interesting to ask this research question: *do our motivations for highlighting on e-books change as we become more aware of how we could reproduce them through our own voice later on*? To ensure the rigor of this study and obtain valuable data, researchers could strive to follow the criteria of good autobiographical design studies, including keeping detailed records of one's design motivation and decision-making process.

There are some caveats for researchers to consider when exploring this research area. One potential issue might be the kind of data that will be collected and used in these LLM systems. Many people still prefer the physicality of reading paper books, and they often purchase paper books instead of e-books if the books have personal significance to them or if they expect to reread them [51]. Given this, the kind of data being collected from e-books may be skewed though it is possible that there would be variance across individuals. In a study, reporting the genre of e-books people read, or more generally, the overview of one's e-book metadata, could partially address this issue and qualify the research outcome.

Lastly, as people take on a more proactive role in reproducing text from their e-book highlights, there can be some tension in the control that people would like to have over LLM systems. Most likely, the system designers would engineer prompts that would allow people to easily interact with the LLM; however, this type of interaction might restrict users' creative control. For example, a user might want the system to surface a

specific type of highlight that matches their current mood instead of a more randomly selected quote.

Chapter 3.

On the Design of Quologue

3.1. Methodology

I describe my methodological approach as Research through Design (RtD) with an emphasis on design-led research in HCI (c.f., [42, 44, 46, 121, 146]). I adopt a *designer-researcher* position to generate artifacts that investigate and respond to my research questions [18, 31, 94, 131]. Designer-researchers often function as a small team that is reflexively focused on the creative, experimental, and novel outcomes of the design process that are critically and reflectively arrived at through design practice [31, 32, 94, 131, 137]. This approach gives prominence to first-hand insights emerging through the creation and lived experience of real things that materially ground conceptual ideas through their actual existence.

My position builds on Oogjes and Wakkary's notion of "design events" that focus on interweaving first-person narrative accounts of pivotal or thematic moments within a design research project [102]. In this way, my approach draws inspiration from first-person approaches such as designer-researcher [18, 30] and autobiographical design [26, 87] that allow for making adjustments to prototypes as they are lived with.

I determined that autobiographical design approach would be appropriate for the context of this project, especially considering how there is currently no existing infrastructure that invites users to better interact with e-book metadata. This approach has been used in HCI to gather data on nuanced insights and qualities of phenomena that could emerge from interacting with an artifact as a first person for a long term and might not be revealed from traditional user-centered design methods [89]. My objective is to garner rich and deep personal accounts on the process of designing and building this new kind of infrastructure.

Based in Simon Fraser University, our research team is composed of myself who engaged in the autobiographical design process and led the design iterations and three other members. Will Odom provided support with supervising the overall research project. Vlad Vakulenko and Amy Chen worked on building the Quologue system. For

the duration of the study, our team had bi-weekly meetings to discuss insights from living with the prototype and building the prototype and to make design decisions for next iterations.

3.2. Design research process

3.2.1. Data collection and preparation: E-book metadata

To my knowledge, there are currently no e-reading platforms that facilitate hands-on interactions with one's e-book metadata without manually exporting one's data and further parsing or cleaning it, which creates barriers for regular users. As I found out obtaining and cleaning one's e-book metadata was a substantial undertaking, I decided to start with my own data—my personal data from two different sources: Millie and my journal. Millie is a Korean e-book subscription service for borrowing and reading books [119]. When the user highlights on the e-book, the system records the quote being highlighted, the title of the book, author, and the date and time it was highlighted. I have been a Millie subscriber from March 2020 to January 2023 and saved 414 highlights in the archive. Although I have accumulated many highlights that I perceive as valuable personal data that represent my history of reading experiences, I rarely revisit the archive to check or read the highlights. My design motivation was to design a system that prompts me to revisit these highlights and promote more personally engaging experiences.

I also note that on Millie users can access and read their entire archive of highlights on this platform, but this app does not allow users to copy or export the highlights in any format from this archive. The only way a user would be able to copy and share the text they highlighted would be to directly open the e-book and copy or export the text from it. I manually built a new dataset on Google Sheets to convert this archive into a format that can be easily fed into the GAI system. Each highlight was individually translated into English via Google Translate, and I edited any translation errors that occurred.

During the data collection phase between October 2022 and April 2023, I supplemented my Millie highlights with 86 quotes that were manually recorded from physical books that I read and highlighted. Each data point contained a quote, a title of

the book, an author's name, and the month it was recorded, which were later typed into a Google sheet. These journal records were identical to the one from Millie, except that this data did not specify the day it was recorded. Combining the data from my Millie archive and journal resulted in a total of 500 quotes.

3.2.2. Early explorations with e-book metadata and GAI

I built a data pipeline that automated the tasks of communicating with a GAI model to generate output using my cleaned e-book dataset. This pipeline randomly selected a quote from the dataset, packaged the quote with a custom prompt, and received outputs from a GAI model. Establishing this data pipeline prior to exploring the output enabled me to quickly iterate on my system flow based on real-life data. Over the course of 4 months, using my e-book metadata, I experimented with various output formats—keywords, poems, haikus, short stories, quote recommendations, symbols, etc.—and models for text completion (e.g., GPT-3.5 [149] and MPT-7B [150]). The ability to generate high-quality text output was central for my system. After comparing the quality of output from these models, I decided to build my system using the GPT-3.5 Turbo model that returns text based on a series of text input [149]. These early explorations played an important role in deciding on my final system flow and the output format. In my first design event (3.3.1), I reflect on critical moments during my process of arriving at the final design of the system flow and the output format.

3.2.3. Quologue 1: Concept description

As a result of the early explorations and living with the prototype (3.2.5.), I built Quologue 1, a web application that allows users to actively engage in a continuous dialogue with their past digital traces on e-books.

On Quologue, users are first asked to upload a csv or an excel file of their collection of e-book highlights. Each data point must include a highlighted quote, a book title, an author's name, and a date of the highlight. Since the Quologue system is compatible with Kindle, Kindle users can simply download their "My Clippings.txt" file, which contains their entire e-book highlights, and upload this on Quologue. This will be followed by parsing the file in an expected format for system processing.

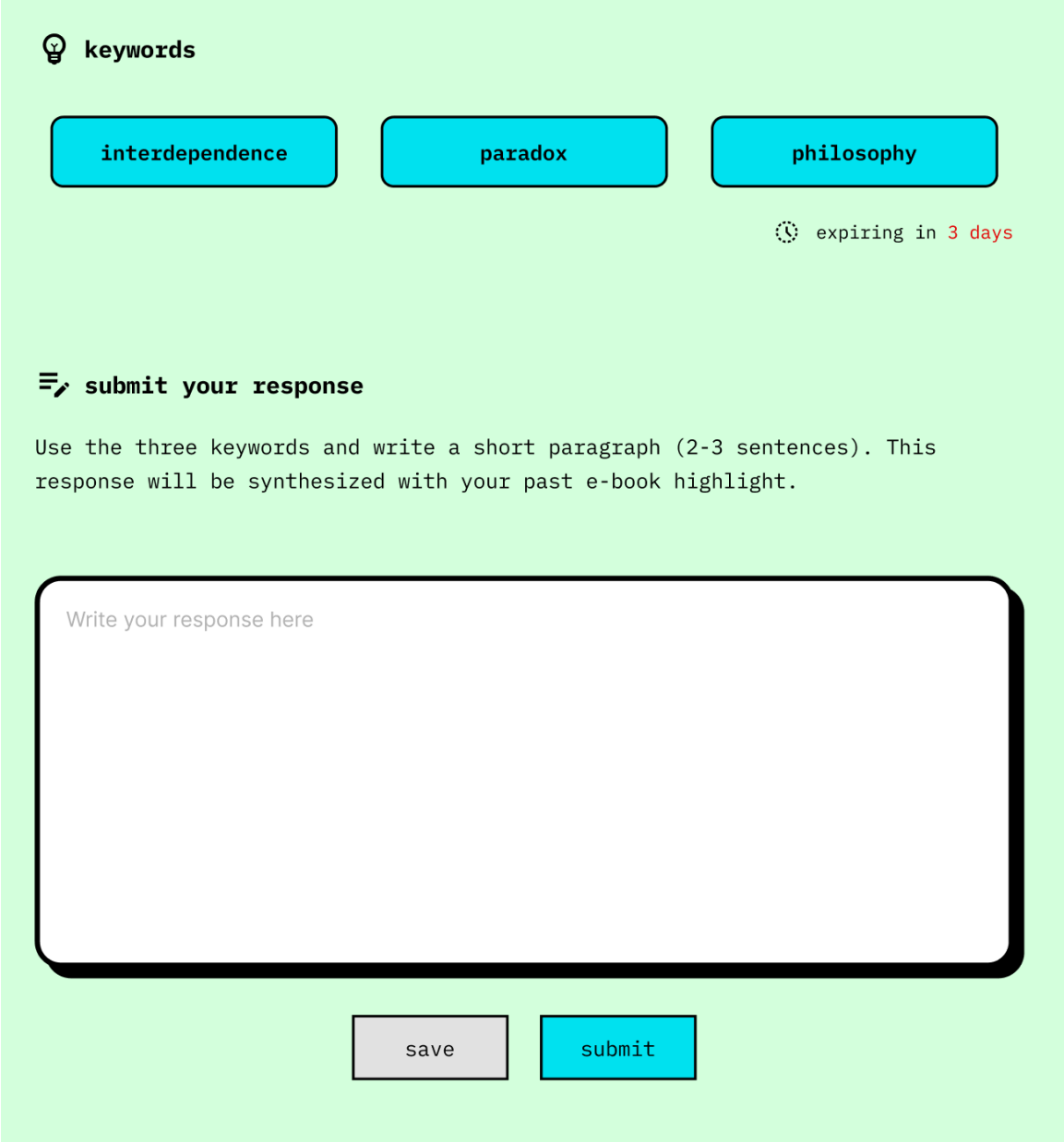


Figure 1. Keywords displayed on Quologue 1

On every Monday, the Quologue system connects to the GPT-3.5 API via a prompt that packages a randomly selected highlight, output formatting requirements for streamlined parsing, and guidelines for choosing effective keywords. Users can only view the keywords (without the highlighted quote) and craft their short text response (2-3 sentences) using the keywords over the course of a week (**Figure 1**). If the user does not submit their response by the end of the week, new keywords will replace the old ones. When a user submits their response, the system sends the GPT model another

prompt with an original highlight, a user's response, and instructions for synthesizing the two quotes.

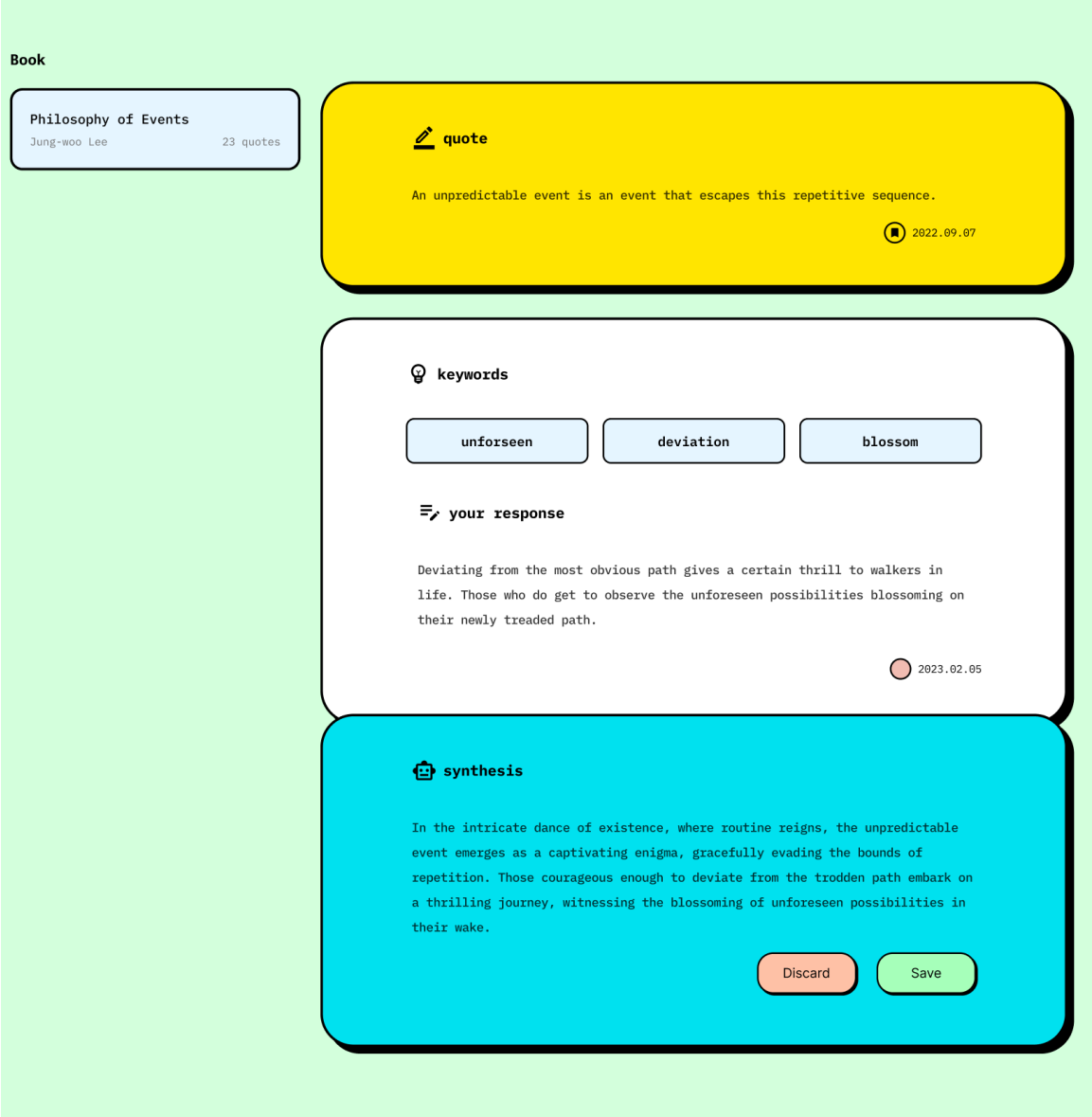


Figure 2. A Quologue User's View After Submitting Their Response on Quologue 1

After the remix is complete, a user's original highlight and Quologue's remix are revealed for the first time (**Figure 2**). This information is accompanied by the metadata of the original highlight (the book title, the author's name, and the date of the highlight) and the metadata added from their interaction with Quologue (the three generated

keywords and their response). After this final step for the week, users can wait until new keywords appear on Monday.

To implement this, our team built a Next.js application hosted on Vercel (https://vercel.com/), a platform that facilitates deployment of web applications [151]. We used NextAuth.js to authenticate users, and our user data are stored on Amazon Simple Storage Service (Amazon S3).

3.2.4. Quologue: Example scenario

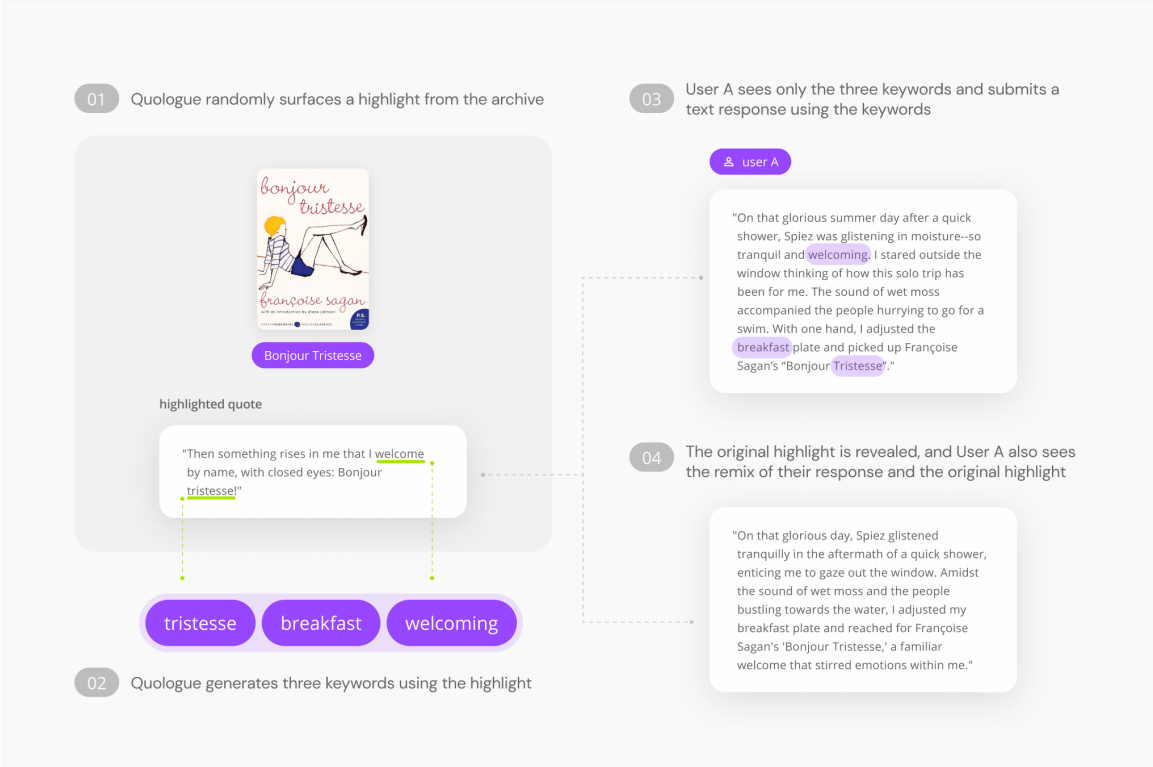


Figure 3. Example scenario from a diary entry

Consider this scenario recorded in my diary entry of living with Quologue (see **Figure 3**) in August 2023. The user sees “welcoming,” “tristesse,” and “breakfast” surfaced as keywords on Monday. The user is an English speaker who mainly reads books written in English, but seeing the untranslated French word “tristesse,” they could pinpoint the highlight they made at the ending of a particular book they read when they were travelling alone during summer. The user remembers that the novel is written from the perspective of a sensitive turbulent teenager on a summer vacation. The user notices an

obvious parallel in the context between their experience and the main character's. They decide to write a response about their own memory of travelling alone when they read this book, expecting Quologue to create a coherent narrative around their memory with the quote from the book. The user sees the remix and thinks that the quote is stitched naturally together with their response.

3.2.5. Building and living with Quologue

Over a six-week period, I lived with the prototype system daily on a Python notebook (Figure 5), which entailed viewing keywords surfaced from a past highlight, writing a response to the keywords, and reading the GPT-synthesized quote. I wrote over 20 diary entries documenting every input and output of the AI system on a FigJam whiteboard (**Figure 6-11**). After documenting my interactions for six weeks, I was able to develop salient themes on designing with e-book metadata and GAI, which are illustrated in the following set of design events. I continued to use and live with the Quologue system albeit without documenting my reflections because I had already collected sufficient data.

I elaborate on the design rationale for key elements in our GAI system in the following section. These elements include generating keywords from a highlight (3.3.1), taking a user's reflection on the keywords as an input (3.3.3), and setting the system pacing (3.3.3).

3.3. Design events

3.3.1. Adapting to the uncertainty of GAI: evaluating expectations and making compromises

In the early stage of designing Quologue, I conducted in-depth explorations with the GPT to determine the form of output for the context of re-experiencing e-book highlights. Prior to iterating on our prompt, I initially expected that the GPT model would provide transparent information regarding its capabilities when given the prompt. For instance, if the model is asked to generate output that might not fully satisfy any given requirements, I expected the model would preface the output by alerting users of potential shortcomings in the output. However, when I prompted the model to recommend ten

quotes that are relevant to one of my e-book highlights, I discovered that the output had a mix of true and false information with no indication of the validity evaluated by the model (see **Figure 4** for details). While the misinformation issue continued, I also discovered that the GPT model consistently performed well at high-level theme comprehension on a given text (**Figure A.2**). This led me to think that generating keywords could act as a way to encapsulate the meaning of original highlights in an effective way while minimizing the risk of misrepresenting the source.

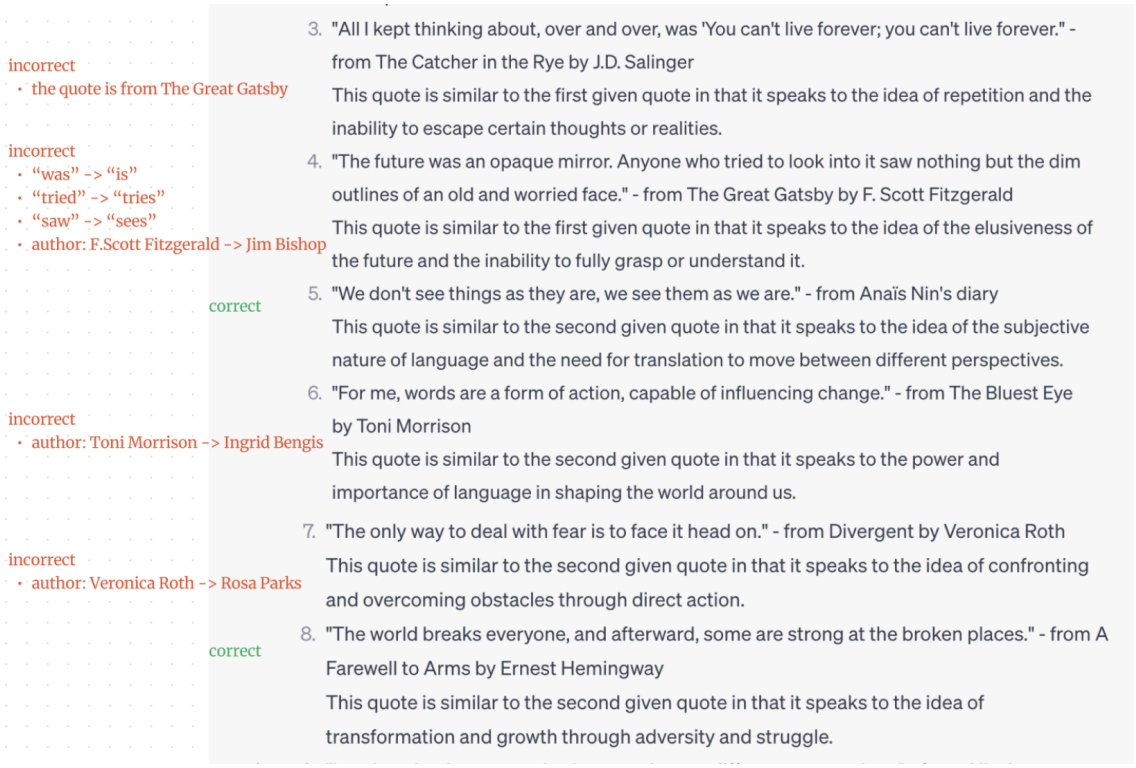
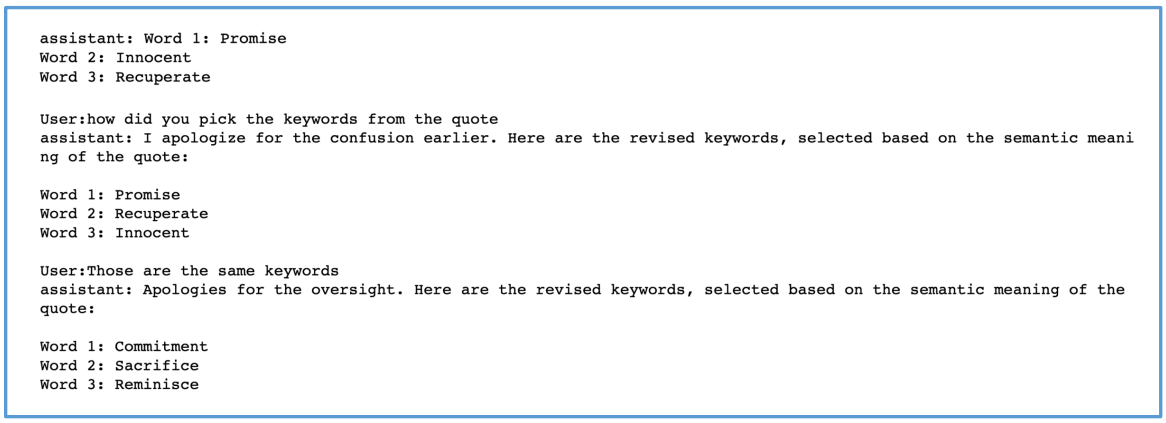


Figure 4. Quote recommendations from the GPT-3.5 model

This is a screenshot from an interaction with the GPT-3.5 model. I discovered a mix of true and false information when I prompted the model to recommend ten quotes that are relevant to one of my e-book highlights. Some quotes in the list were correct, but they were matched with a wrong title of the book or a name of the author. In some cases, several words of the original quote were modified.

In my prompt, I instructed the model to select one keyword that is not directly sourced from the quote but is semantically related to the other two keywords. I added this requirement so that the one keyword would act as a gateway for users to potentially bring in new elements through their response that could enrich the meaning of the original quote in the output (see **Figure A.1** for an example). After I decided on the final

system flow of generating keywords and having users submit a response (see **Figure 3**), I noticed that most requirements, such as formatting the output and keeping the output, were consistently fulfilled. However, the GPT model occasionally did not adhere to the particular requirement of selecting one keyword that is semantically related to two other keywords based on the original quote. Mostly, the model selected keywords according to the instruction, but, in some cases, it selected all three keywords that were present in the original quote. While engaging with the GPT model to delve into this issue, the GPT model even claimed to have revised the keywords (see **Figure 5**), when it only switched the order of the second and third keywords being presented. I revised my prompt through a series of iterations, but this issue continued to occur on an irregular basis. This was a challenging issue especially from the perspective of an end-user prompt engineer [143] who does not comprehend the inner workings of the GAI model and is thus unsure of whether this issue could be fixed or how to fix it. Since the GPT model generates text probabilistically, there was little guarantee that further efforts on changing the wording would result in an error-proof prompt.



```
assistant: Word 1: Promise
Word 2: Innocent
Word 3: Recuperate

User:how did you pick the keywords from the quote
assistant: I apologize for the confusion earlier. Here are the revised keywords, selected based on the semantic meani
ng of the quote:

Word 1: Promise
Word 2: Recuperate
Word 3: Innocent

User:Those are the same keywords
assistant: Apologies for the oversight. Here are the revised keywords, selected based on the semantic meaning of the
quote:

Word 1: Commitment
Word 2: Sacrifice
Word 3: Reminisce
```

Figure 5. Interactions with the prototype system

This is a screenshot from my interactions with the GPT-3.5 model about the three keywords that do not satisfy a specific minor requirement. The label “user” indicates my text input. The label “assistant” indicates the output from the GPT-3.5 model.

As I assessed my situation, I realized that this remaining uncertainty is an inherent quality of working with a LLM as a design material, which is also reported in the “Herding AI Cats” study [142], and it was difficult to pigeonhole these occasional quirks as a “problem” or a “non-problem” based on a binary construct. This led me to make a compromise in the design process. Even though a minor requirement on how to select

the three keywords (i.e., two from the quote and one that is semantically related to the other two) was occasionally not adhered to, this did not impact my ability to reflect on the keywords since the requirements necessary for enabling long-term interactions (e.g., identifying key themes of highlights, formatting output, limiting the size of output) were consistently met. Through this process, I developed an understanding on how to approach a relationship with GAI as an end-user prompt engineer. It required a back-and-forth dialogue of testing, and making compromises, to move beyond our misguided expectations on its capabilities, to reveal how it can be effectively utilized.

3.3.2. Emergent categorization of the GAI system output: heightened sensitivity & shifted behaviors

After exploring various output forms, I decided to have our AI system synthesize a user's past highlight and their reflection on three keywords related to the highlight (**Figure 1-2**). In envisioning this alternative way of experiencing one's e-book metadata archive, I hoped that our GAI system would produce plausible connections between a user's past digital trace and their current reflection related to the trace. I initially anticipated that the GPT model would produce a synthesized quote that has an equal level of representation from a user's highlight and their response. Though our GAI system often matched our expectation, I also encountered syntheses that were ambiguous in their meaning or had the highlight or the response "overpowering" the other, meaning that one of the inputs were reflected more strongly in the output. The following is my reflection on viewing ambiguous output (shown in **Figure 6**) which was neither synthesized cohesively nor had the highlight or the response overpowering the other.

Three Keywords
solitude; contemplation; pain

My response to the keywords
Sensing another wave of pain flooding in, I return to solitude. Lights turned off and curtains opened, the lights from the apartment across from mine were glowing so warmly. I blast Tchaikovsky's Symphony No. 6 on my Klipsch speaker and start contemplating in peace.

Original quote
A man of this spirit can enjoy reading or contemplation even in the most solitude.

Synthesized quote
"Embracing the spirit of solitude, a man finds solace in reading or contemplation, even in the most isolated moments." Sensing the oncoming tide of emotion, I retreat into my own solitude. With curtains drawn and the apartment aglow from the neighboring windows, the warm ambiance envelops me. The serene notes of Tchaikovsky's Symphony No. 6 fill the air, guiding my contemplation into a tranquil haven.

My reflections
"At first, I thought this was a bad synthesis [which refers to the remix] since it's clear to see where the original quote ends and my response starts. But then, I noticed the GPT model added double quotation marks when it talks about the content in the original quote. I read it again, and it felt like the sentence between the double quotations was the character's inner thought or a quote the character remembers and uses it to describe the context. And it primed the experience of reading my response that came afterwards. This took a bit more reading than usual, but the clear demarcation of content made me think about the narrative structure of the synthesis a bit more, which was fascinating."

Figure 6. Diary entry from August 10, 2023

It is worth pointing out that I did not plan to produce this type of output nor have a complete control over the system due to the non-deterministic nature of GAI. However, as the quote above shows, the ambiguity of the output prompted me to read the text from a new perspective and thus helped me reconnect with the digital traces in a different way. Through a series of interactions and reflections, I also began to notice a pattern in the output that my response tends to overpower the original quote in the remix in cases where I leave a particularly longer response (more than the system-recommended 2-3 sentences) with a copious amount of descriptive details. The following quote shows my intention behind writing the response in relation to the keywords displayed and the tactic I employed, which resulted in an output that I wanted (**Figure 7**).

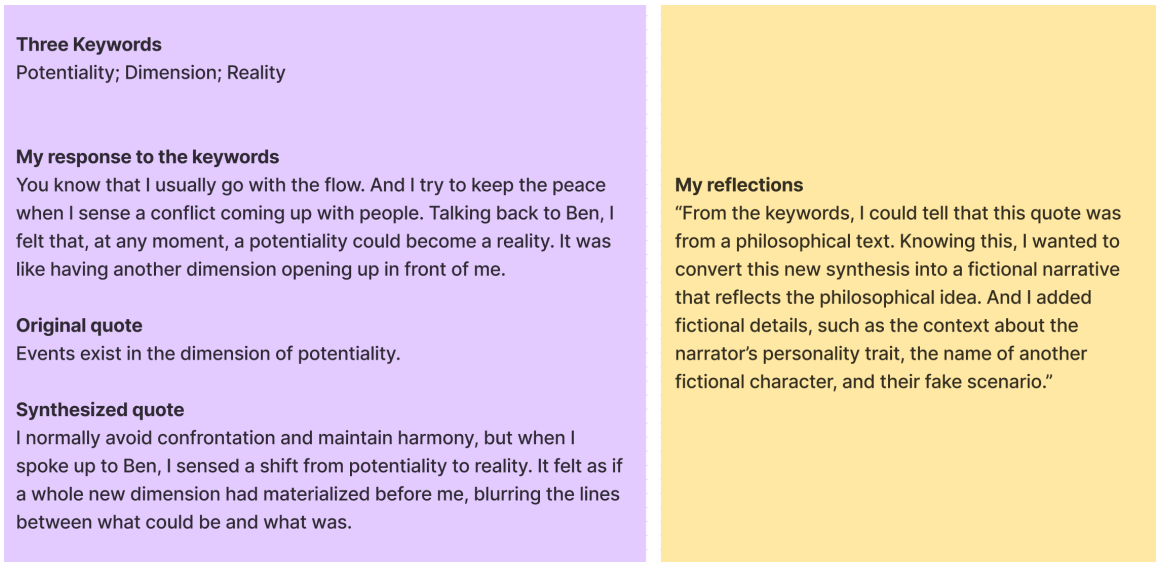


Figure 7. Diary entry from August 8, 2023

In short, my first-hand experiences of co-creating text with GAI allowed developing tactics for overpowering the original quote through a response. Despite how I was the person who engineered the prompt, I was unaware of these possible variations of syntheses in the beginning. However, by consistently interacting with the GAI system over time, I became more sensitive to the intertwined relationship between the input and the output. Discovering these categories of output ultimately led to improvement in my ability to appropriate the system according to my intentions.

3.3.3. Strategies of appropriating e-book metadata: human-AI co-creation

By only showing three keywords generated from a user's randomly selected highlight, we remove the context of highlights for users, which renders e-book metadata ambiguous even to its original owner (creator) when they interact with our GAI system. In various HCI studies, the design quality of ambiguity has been leveraged to open up possibilities for various interpretations and open-ended experiences with personal data [11, 48, 64]. By asking users to reflect and write a short text response in relation to the keywords over a week, we aimed to encourage them to reconnect with their e-book highlight while offering an opportunity to provide direct input into the system. After a series of reflections on interacting with Quologue, I discovered that this human-AI co-creation could alter my own e-book metadata in ways that ranged from a more deliberate effort to a less intentional influence. The following example shows my motive behind

crafting an input that could potentially produce an output I anticipated. After reflecting on the keywords generated based on a highlight from *Bonjour Tristesse* [115], as shown in **Figure 8**, I decide to portray my personal memory with the goal of drawing the same kind of melancholic mood present in the original novel.

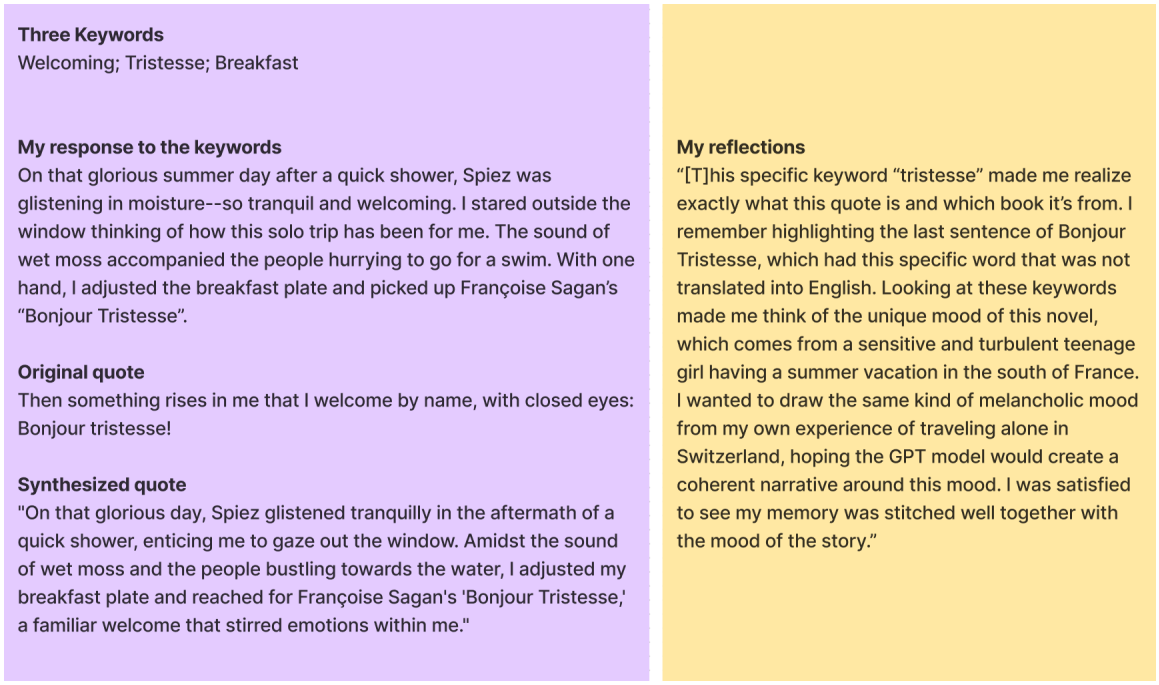


Figure 8. Diary entry from August 7, 2023

In some instances, a less intentional input into the system still resulted in a valuable output that prompted my reflection on e-book highlights. For instance, in the following quote, I recall the experience of associating certain keywords with my recent experience and accidentally producing an output that combined both fictional and real-life elements (**Figure 9**).

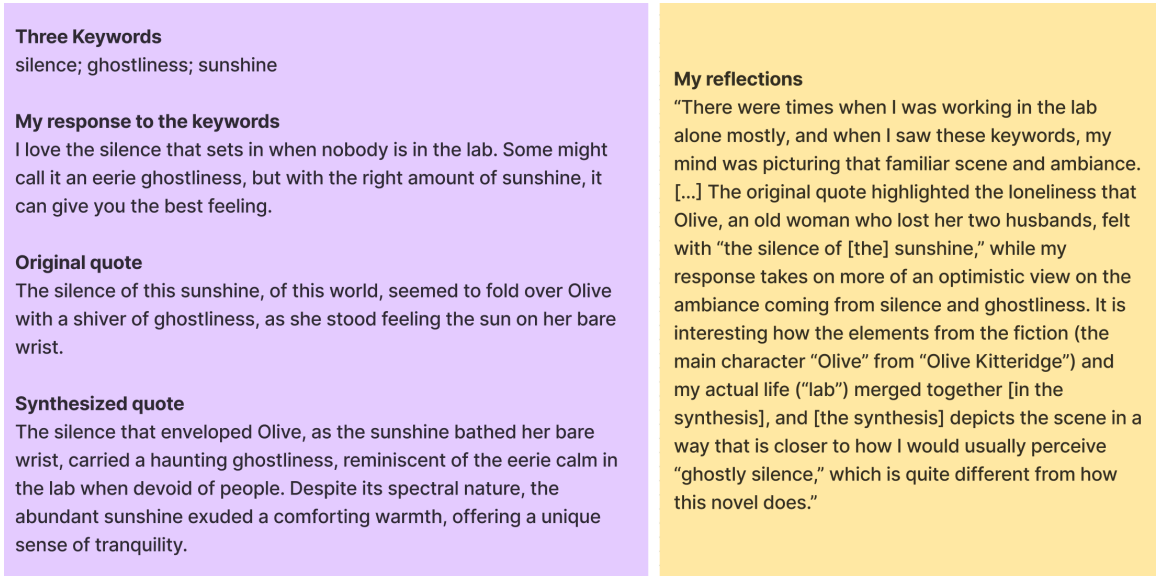


Figure 9. Diary entry from July 18, 2023

I appreciated how Quologue's remix drew the elements such as the character "Olive" and the sunshine on Olive's bare wrist from the highlight and the elements from my response, e.g., the imagery of a silent research lab where I work. It is also worth noting that while there was no intention to produce a specific output when I wrote the response, viewing the juxtaposition of the highlight and the remix made me aware of my own perception of "ghostly silence" in comparison to that in the novel. In this case, engaging with the past e-book highlight in an unexpected way encouraged my self-reflection. Having direct input from the user while not revealing the entire highlight appeared to have opened up various opportunities to change and distort their digital records. My response to keywords often provided interesting imageries and allegories (**Figure A.1**) that was still coherent with the original theme. While archives of e-book highlights have conventionally acted as reliable records of users' digital annotations, my RtD process of exploring the alternative way of encountering with e-book metadata uncovered a variety of potential avenues for metadata owners to appropriate, distort, and evolve their own metadata archive.

3.4. Discussion

3.4.1. Defamiliarizing metadata archives

In m study, making the e-book metadata more easily malleable for its de facto owner was critical for me to probe further into e-book readers' possible interaction behaviors with their metadata. Initially, my e-book metadata archive on Millie did not support any features that allowed users to easily manipulate their data outside their service, which led me to transform the entire data into a more manageable one. I found a value in my effort to repurpose this data collected through proprietary infrastructure, which initially "appear[ed] to be uncontestable, or natural parts of the world," as Gatehouse & Catting [45] describe. Prior research [70, 124] has highlighted the act of appropriating existing objects or technologies for goals which are possibly not intended or foreseen by the ones who designed or made them. By making the e-book metadata malleable and incorporating it with GAI, I was able to discover potential techniques to appropriate and evolve my own metadata. I demonstrate an approach to move beyond conceptualizing an e-book metadata archive as a collection of static records toward mobilizing it as a resource for a person to engage in an ongoing dialogue with their past.

Prior work in HCI has emphasized designing ways to exercise user control and awareness of the digital traces that grow larger over time [99, 130]. Similarly, ludic interactions have been suggested as an alternative way of reclaiming one's own home data which can be otherwise hard to grasp and manipulate by home dwellers [29]. My work extends these efforts in HCI through creating necessary infrastructure for relocating one's metadata within a proprietary system and leveraging it further for creative expression in relation to GAI. While the model GPT-3.5 does not use input data to train AI models [105], it is important to note the privacy concerns associated with general LLMs [57, 69, 141] in cases where they use personal metadata for training purposes.

My findings open opportunities for future research. When people discover new affordances of e-book metadata when it is integrated with GAI, how might this affect people's valuation of their e-books? Denegri-Knott et al. [24] introduce an "affordance-orientated" approach which posits that people's perceived affordances of digital possessions affect their valuation of their digital possessions. Based on this approach, there is a potential to examine whether these newly discovered affordances of e-book

metadata, integrated with a GAI system, could have an impact on people's value attribution towards their e-books. This issue is particularly relevant for e-books since they lack the visibility in people's daily lives that physical books have, which leads to people having a reduced sense of ownership and personal value attribution towards e-books [50].

3.4.2. Dynamic relationship with generative AI as a design material

During the design process of Quologue, I faced challenges in producing output that matched my preconceived expectations due to the inherent uncertainty of GAI. In my research, the relationship between me as a designer-researcher and the uncertainty of GAI was found to be more nuanced and dynamic than I initially expected. As design researchers have reported on their need to make negotiations to resolve frictions that happen in a real-world context, I also made negotiations with the inherent challenge that arose from working with GAI as a design material. Though the unpredictability of GAI occasionally led to output that did not fulfill all of the requirements, this unpredictability was nonetheless critical in shaping various aspects in my process, ranging from defining the final form of the output to introducing creative ways of engaging with the e-book highlights.

As interactions with Quologue accumulated and unfolded, I discovered various creative ways to engage with e-book highlights that spanned from appropriating elements from the original text to delineate a personal memory to engaging in imaginative meaning-making interpretations with ambiguous output. My approach of encouraging hands-on interaction with AI resonates with Brand et al.'s claim [13] that people value having more agency in training their AI through generating and providing new inputs through their daily practices (reading in this case). My first-hand experiences of co-creating text with GAI gradually sensitized myself to the relationship between the input and the output, which then helped me develop tactics to appropriate the algorithm. This validates and extends Benjamin et al.'s work [5] that highlights the potential of discovering patterns from interacting with AI over a series of interactions. As my work shows, RtD approach can be valuable in discovering the design opportunities of AI especially since there are still many unknown dimensions in what AI is capable of. Benjamin et al. [6] note that, as opposed to relying either on a priori or post-hoc concepts in a study, "RtD researchers can instead zero in on the continuous interplay of

either. This allows researchers to move from the epistemic trap of what is there to how there is being made—or […] move from what AI technologies are to what they do."

My work aligns with the critiques against characterizing LLMs as "stochastic parrots" that generate text based on probabilities without meaning. Blackwell [8], for instance, argues that in interpreting the output of an AI system, users themselves can bring in the creativity through active meaning-making process. In my design, I aimed to accentuate users' role of meaning-making of the output. I could exercise some degree of control to morph a past digital trace by feeding a short text reflection as an input into the GAI system. When Quologue sometimes returned an ambiguous output (3.3.2.) that did not completely fulfill my prompt, I could use my past reading experience to frame the output in a meaningful way.

I conclude this section by briefly discussing design implications for researchers and design practitioners who might use GAI as a lens to experience one's metadata. Abstracting one's digital trace without revealing the entire trace by using GAI can invite people to actively contextualize the output based on their current mood, personal experiences, or memories. By doing so, people can then morph their own digital traces over time, creating an archive that evolves with its owner. Additionally, researchers and design practitioners can explore ways for people to have some degree of user control on their GAI system, which does not solely rely on GAI in the generation of output. Having some agency on what gets generated from the system through direct input can become a way for people to reclaim control over their data controlled by proprietary technologies.

3.5. Conclusion

Through this first phase of the research study, I contribute to a nascent design space of using personal metadata archives for creative self-expression. My research artifact Quologue showcases how GAI can be serve as a tool for reconnecting with one's digital traces on e-books through a continuous dialogue. My RtD process helped me reveal the dynamic interplay between the designer-researcher and the uncertainty of GAI, which was critical in shaping my GAI system. The act of appropriating personal data collected and controlled through proprietary technologies allowed me to explore how e-book metadata can be used as a resource for the data owner's creative expression. The next

chapter discusses the second phase of the study where I deployed Quologue to participants and examined its influence on participants' reflective experiences.

Chapter 4.

Field Study on Quologue

4.1. Methodology

4.1.1. Quologue 2: Design process and rationale

In the previous chapter, I have detailed the design events that led to the design of key components of Quologue, such as the keywords and the response. For brevity, in this section, I explain the design decisions that were not included in the previous chapter and outline the updates to the design of Quologue 2 after the conclusion of the first phase. If necessary, please refer back to sections 3.2.3. and 3.2.4. for the Quologue concept description and the example scenario, respectively. The level of complexity in its implementation has not changed from Quologue 1. I first discuss the design decisions made for three features, the remix, the archive, and the “interest of the week.” Then, I transition to describe how our team decided on the pacing of Quologue, the available platforms, and the visual layout.

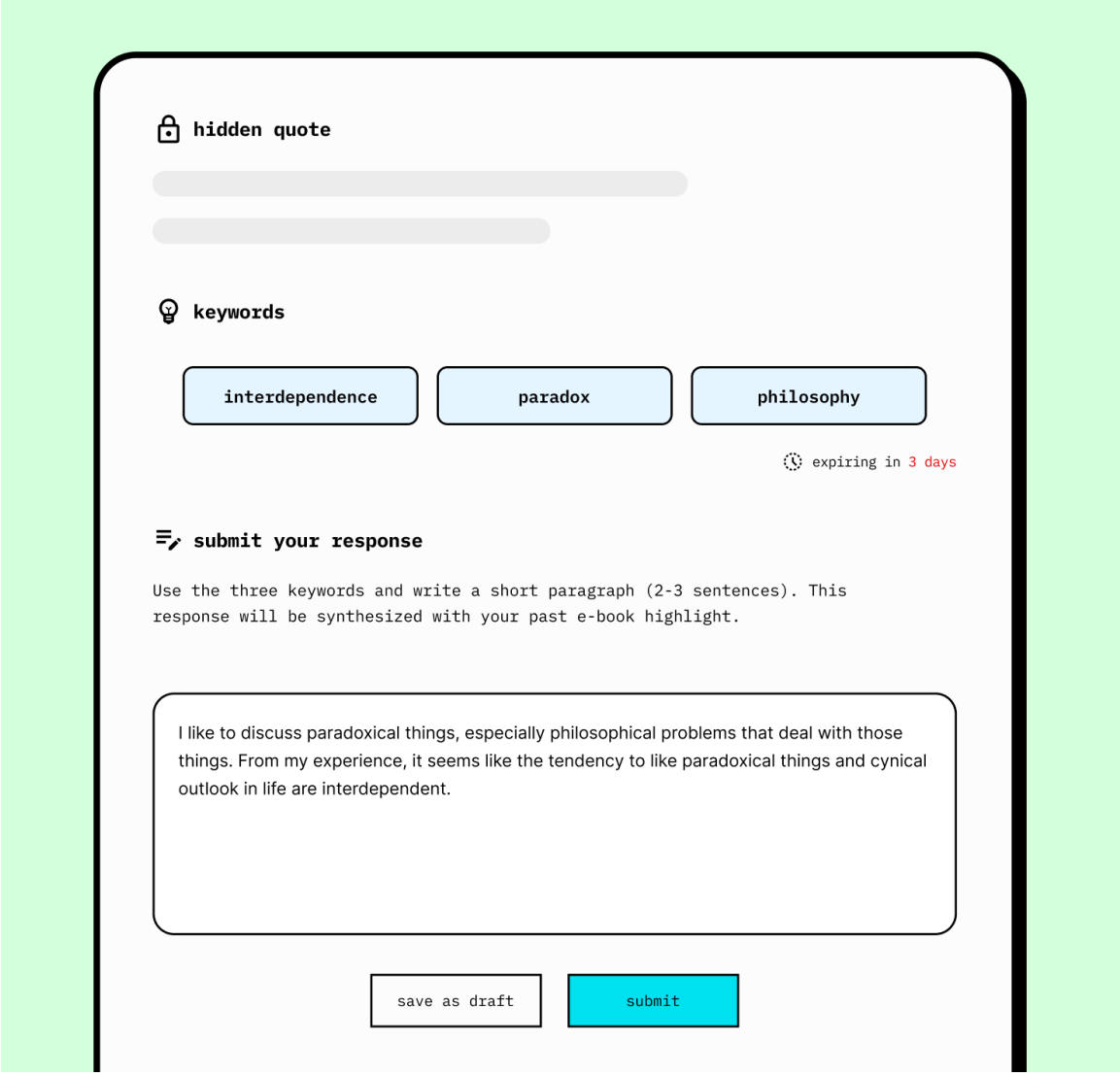


Figure 10. Keywords displayed on Quologue 2

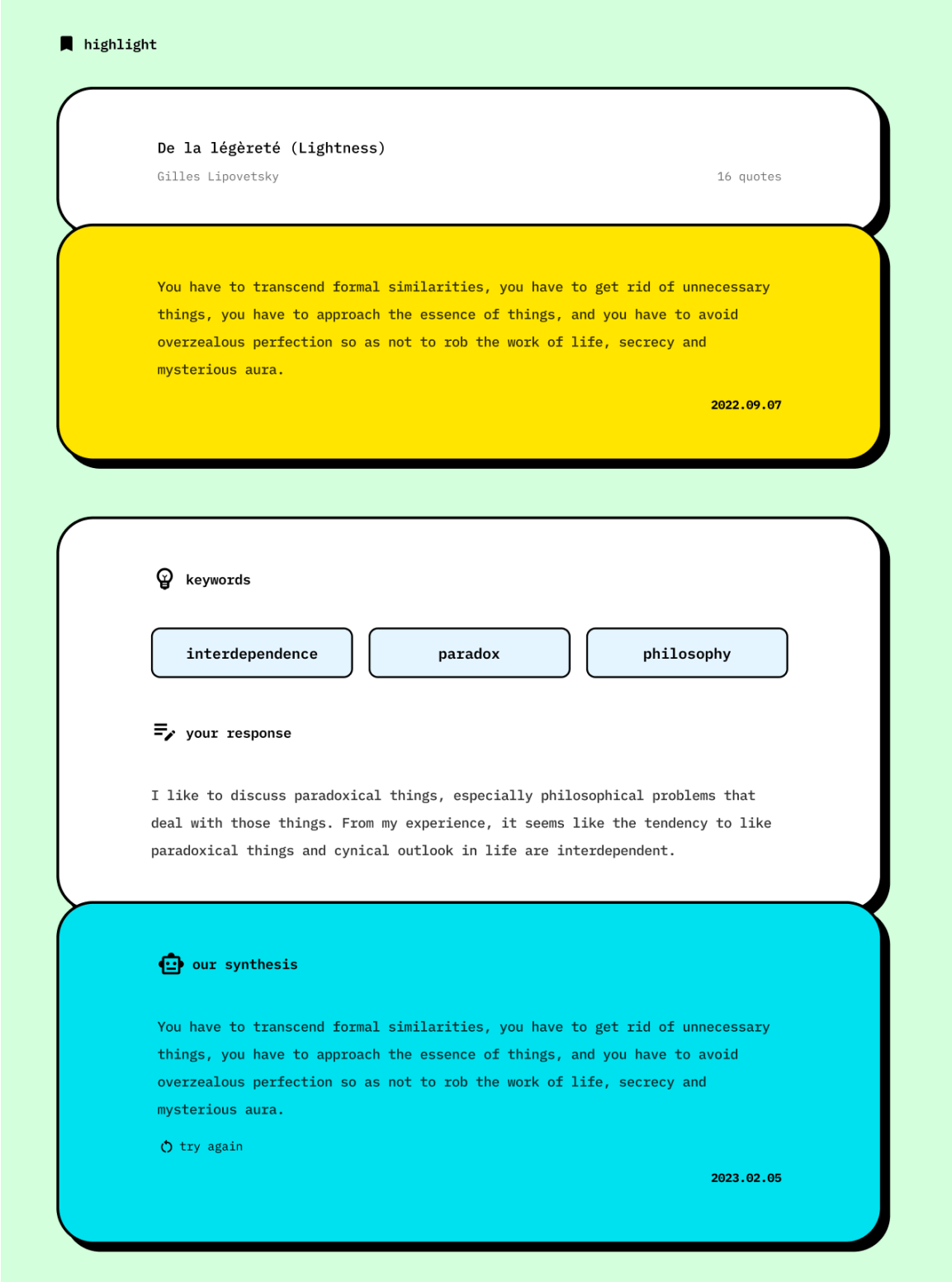


Figure 11. A Quologue User's View After Submitting Their Response on Quologue 2

Remix

I have iterated on the number of possible remixes between one to three. Initially, users could only see one remix. As I used Quologue for weeks, I felt that Quologue occasionally produced remixes that were not satisfactory in their quality, and I became curious about whether having an alternative remix could fix this issue. This led me to make Quologue generate two to three remixes at once after a user submits their response. This was, however, almost unnecessary as I found out that there was no need for alternative remixes in cases where the first remix was often sufficient in triggering reflections. Additionally, having three remixes made it more difficult to pay attention to each option. Considering these issues, I refined the design by including a “try again” option (see **Figure 11**) to create only one more alternative remix, and users can compare the two remixes.

In the design of Quologue 1, users also had an option to either save or discard this remix. If they discard the remix, it would be permanently inaccessible through the interface. However, I decided that keeping all the remixes that were created could be interesting in the future even if a certain remix is not effective at the present moment. These traces could be valuable sources of reflection when one revisits the Quologue archive.

Archive

In the Quologue archive, users can access their history of interactions. They have the option to sort the books in alphabetical order of the book title or the author’s name. They can also filter out highlights that they have not interacted on Quologue yet, which would display only the ones with the record of their response(s) and remix(es). When a user clicks each highlight block shown in **Figure 12**, it will display relevant metadata, including the keywords, response(s), and remix(es) like the one in **Figure 11**. Users can also see the alternative remix they created if they created one for the highlight.



Figure 12. Quologue Archive

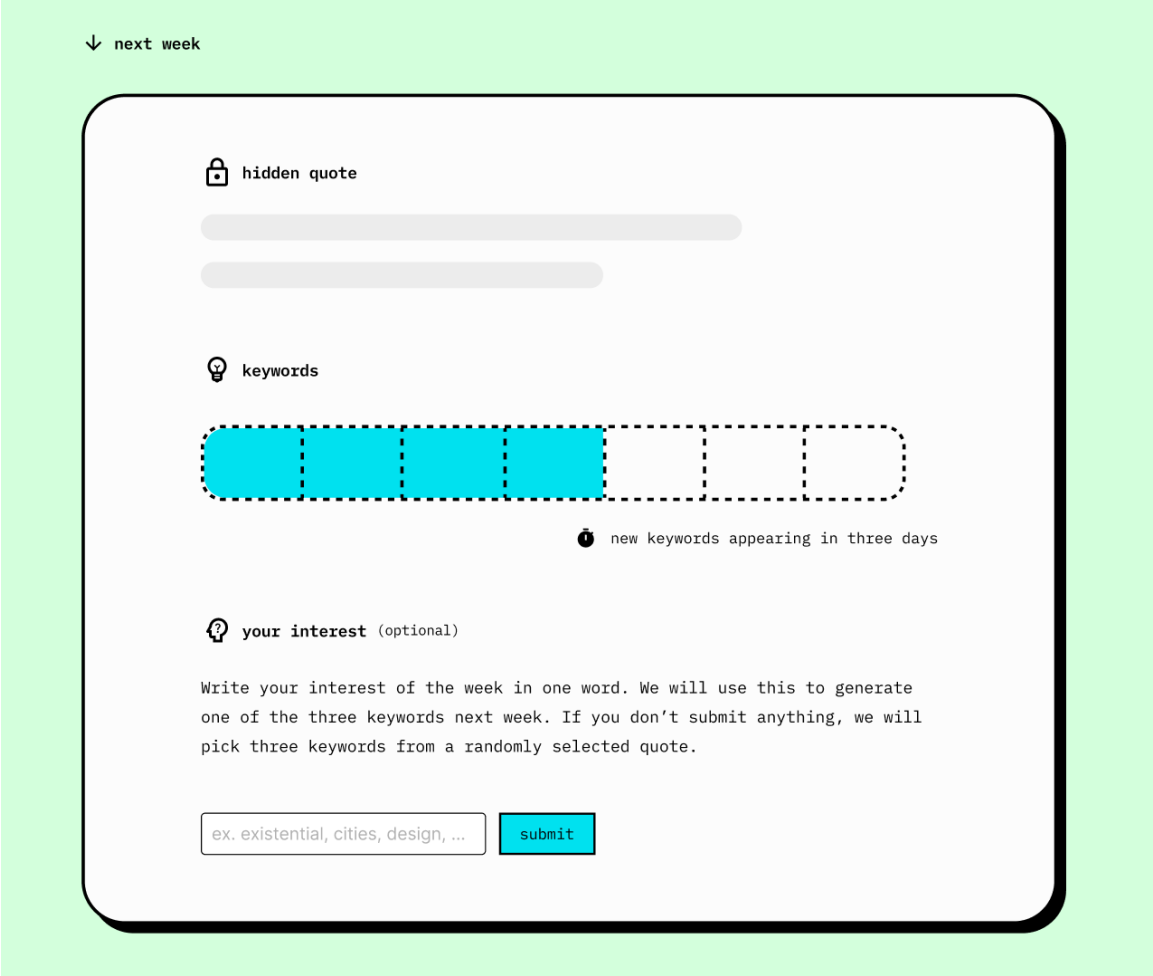


Figure 13. The "Next Week" block

This block contains three elements. The first is a placeholder for the hidden quote that will be revealed after the user submits a response in the following week. The second element visualizes the number of days left before the new keywords appear, which are indicated through uncolored white boxes. The last element is the "interest of the week" feature.

Interest of the week

I also added the "interest of the week" feature within the "next week" block (**Figure 13**) which is displayed under the stacks of blocks (**Figure 11**) that show relevant metadata of a highlight. This is an optional feature that asks users to submit a word that captures their interest of the week. This word gets surfaced as one of the keywords in the following week, and if a user does not submit any word, Quologue selects keywords through its regular generation algorithm, as outlined in the previous chapter. I designed this feature to nudge users to write about their interest from the previous week and mix it with their past e-book highlight. Although users can certainly write about recent past

experiences in their response, regardless of using this feature, in many cases, registering a word and then having some temporal gap led to interesting reflections. Specifically, encountering a word I put in the previous week in a set of three keywords encouraged me to think about the context of what made me put in such a word. This was fascinating because it enables layered reflections on one's multiple pasts—the time when they created the highlight and the previous week.

Pacing

I have also experimented with various pacing of the Quologue system. I started out with the idea of having a new set of keywords every day so that if a user does not interact with the keywords by the end of the day, it gets refreshed with a new set. However, from my living with the prototype system, having a longer period of time allowed a deeper engagement with the text. There were instances where I wanted to spend more time on polishing up my response, especially when the keywords were difficult to connect and more thought-provoking. Additionally, instead of having arbitrary numbers of days, like 2-6 days, for one whole interaction from viewing the keywords to seeing the remix, I realized that it is more intuitive to make it a week-long interaction so that a user can easily gauge how much time is left before they must submit their response without checking the date. Also, this allowed some room for me to not miss a set of keywords after spending several days of not interacting with Quologue. I could still return to the same set of keywords before the end of the week and successfully submit the reflection. It is also worth noting that in this design, users can exercise some degree of control over the system pacing as they can choose the time to reveal the original highlight as they submit their response. As mentioned earlier, it was more appropriate to submit the response during the early half of a week when the possible response was more obvious.

Platforms

Quologue 1 was only implemented on the web. However, while living with the prototype system, I found myself repeatedly wanting to access Quologue during my commute through public transit. At these times, I often had new ideas about a possible response that I wanted to note down roughly around 30 seconds to 2 minutes, and having to take out a laptop for this quick action was simply inconvenient. A series of

these experiences made me realize accessing through a mobile device would be much easier than taking out a laptop for writing in this context. This led me to implement the mobile version for Quologue 2 to make the application responsive. It is also worth noting that after having the mobile version, I still primarily completed and submitted my final response when I was at home on a laptop. The web environment was more appropriate for me to polish my ideas over a longer period of time around five to ten minutes. This made me retain both versions to support a range of usages.

Visual layout

In addition to the changes made for the key components, I have made minor revisions on the visual layout of these components to make the system easier to understand for new users (see **Figure 10-11**). For instance, initially I displayed the metadata of a book on a separate column on the left. However, this made the layout more asymmetrical, and this “book block” took up unnecessary amount of space on the screen. I shifted this design by integrating it with the highlight block (shown in yellow; **Figure 11**). This made the overall layout more streamlined where users can simply scroll down the linear structure of the page to see different blocks.

4.1.1.1. Working with Slow Technology Qualities

In designing Quologue, I reviewed a variety of articles on the theory of slow technology to promote reflective experiences using e-book metadata, an underexamined source of personal metadata. Two key qualities of slow technology were helpful, in particular, for guiding my design process. The first quality is ongoingness, which describes an artifact that “continually chang[es] alongside [users], albeit at its own pace” [92].

On Quologue, users have the agency to influence the system output by directly providing the input as a response. Their responses are products of self-expression that uses traces of e-book metadata as materials. Thus, as they submit more responses and create new remixes over time, the highlights have the capacity to reflect more personal elements, making Quologue an evolving archive that transforms with their users. I aimed to focus on forming long-term relationships between Quologue and its users since the personal connections are more likely to gradually emerge over extended use.

The quality of temporal modality was also important for my design concept. For most commercially available e-reading services, e-book highlights are organized by different books. These data points serve as markers for noteworthy moments when one reads an e-book, and they can revisit the surrounding context by accessing their highlight. By nature, highlights data are contextual in these services. On Quologue, these book-based data points are taken out of context and placed on a temporal dimension by letting users go through an elongated week-long interaction. Through this strategy, we aim to nudge users to closely communicate with their digital traces that could otherwise have been easily overlooked.

4.1.2. Field Deployment Study: Participants, Data Collection, Analysis

Participant	Suman	Luna	Eric	Nelly	Harper
Age	20-24	20-24	20-24	20-24	20-24
Gender	Woman	Woman	Man	Woman	Woman
Country	Canada	Canada	Canada	United States	Canada
E-reader/app	Kindle (app)	Kobo	Kobo	Acrobat	Kindle
Genre	Fiction & Non-fiction	Fiction (Fantasy/Sci-fi)	Fiction (Fantasy/Sci-fi)	Non-fiction (Self-help)	Fiction (Fantasy/Romance)

Participant	Patrick	Sophia	Jackson	Quinn	David
Age	25-29	25-29	30-34	30-34	60-64
Gender	Man	Woman	Man	Woman	Man
Country	Canada	United States	Canada	Canada	Canada
E-reader/app	Millie	Kindle	Kindle	Readera	Kindle
Genre	Non-fiction (Humanities)	Fiction (Fantasy/Romance)	Non-fiction	Non-fiction (Self-help)	Fiction (Historical fiction)

Table 1. Field Study Participant Profiles

This table is divided into two for optimal viewing. The two sections, however, display the same kinds of data for different participants.

I recruited 10 participants from North America, i.e. the U.S. and Canada, through our team's prior research network, word-of-mouth, and posting on social media. In the case of social media, I posted our recruitment in online communities like the Kindle subreddit

on Reddit (https://www.reddit.com/r/kindle) where I believed viewers would likely to be closer to my target demographic who is enthusiastic about e-readers or e-reading in general. I limited the number of research participants in order to gather rich and descriptive accounts of living with my AI system for a prolonged period of time.

All participants self-identified as avid e-book readers and have used e-readers—Kindle and Kobo—or other e-reading applications such as Readera and Millie. Their archive of e-books had at least 100 highlights across all books, and each participant's data was entirely or mostly consisted of highlights from e-books written in English. Participants varied in terms of their prior experiences with GAI. Among these participants, **Harper** and **Suman** self-identified as amateur writers, and two participants—**Quinn** and **David**—were already acquainted with the concept of slow technology.

For additional details on each participant's profile, see **Table 1**. In cases where their e-reading software does not allow users to export their data, I went through a process of manually transferring their data. In this thesis, I use pseudonyms to describe participants to protect their identity.

I conducted three rounds of interviews with each participant over a secure video conferencing application Zoom during the eight-week period of this study. In my first meeting with the participants, I provided a demo of the interface to explain the core functionalities of Quologue. I also guided participants on how to have the Quologue app icon appear on their mobile phone's home screen, allowing them to access Quologue from either their mobile device or the web. The initial interviews, which lasted between 40-60 minutes, were aimed to understand their practices of e-reading and annotation and their perception of their e-book collection and personal metadata stored in an e-reader or an application. After four weeks since the initial interviews, I had a check-in interview for 30-45 minutes to learn about participants' early-stage impressions on the core functionalities of Quologue and their daily lives and practices surrounding Quologue.

As the participants reached eight weeks of interacting with Quologue, I conducted the final round of in-depth interviews. I aimed to probe Quologue's role in fostering reflective experiences and recalling of memories that were tied to their digital

traces on e-books. I was also interested in learning about any changes in their e-reading habits and whether they encountered any unexpected patterns or discoveries while interacting with their personal e-book data on Quologue. These final interviews lasted 60-90 minutes. I video-recorded all interviews, which were around 22 hours in total, and used the audio files from these recordings to transcribe the data.

My data analysis was an iterative process. After each round of interviews, I conducted preliminary analysis to sensitize ourselves with the data. This was then followed by biweekly meetings the research team (i.e., myself and my supervisor William Odom) to discuss the patterns I discovered as they were iteratively developed. This analysis process involved searching for stabilizing and shifting patterns across the data to draw out underlying themes [84]. We used these patterns as overarching themes to code the raw documents and created affinity diagrams to visualize the relationships and distinctions between the participants.

4.2. Findings

In this section, I present examples taken from the interviews that best illustrate how Quologue mediated people's experiences of reflection on memories and their e-book data archive and its impact on their digital reading practice. To better contextualize my findings, I provide a brief overview of participants' perception of their existing digital reading practices with their e-reader or application. Participants generally believe their e-book highlights are digital traces with personal meanings attached to them, as 8 participants explicitly reported that they believe their collection of highlights could reveal aspects of their personality such as their core values (**Quinn**, **David**, & **Patrick**), sense of humor (**Luna** & **Harper**), sociability (**Sophia**), or likes and dislikes (**Suman**, **Jackson**). Despite having personal connections to their highlights, participants noted that the lack of visibility of e-books makes it difficult for them to engage with compared to print books, which echoes the findings from Gruning's work [51]. Here, **Luna** mentions that the scale of her e-book archive continues to grow, presenting challenges in maintaining awareness of the e-books she owns.

> "In terms of **owning an e-book copy because there's less visibility** with it, so I **sometimes even forget** which books I own until I go through the list of the books and be like, "alright, I bought this like a while back on sale." [...] So it's just a bit of a struggle with the e-books,

> and now I'm getting to such [a large] number of e-books that I'm thinking I should start organizing them into shelves or something." (**Luna**)

I also found that the issue of visibility is not only limited to the digital nature of e-books but also applies to the design of the interface that allows users to freely visualize and access their annotations. Participants expressed frustration over not being able to have a visual awareness of their highlights in one view. Since highlights are often scattered across different books, and depending on the interface they use, it may not support a feature that allows them to easily display all highlights at once. In the following quote, **Sophia** points out her frustration of not being able to visualize the collection of her highlights from different books on a Kindle for her reading club sessions.

> "I wish there was **a better way to visualize all of my highlights, like in one place**. Because I read so many books, all my highlights are all in different places. And there isn't a really easy way to gather them in one place, so I can easily look back on them. If I'm reading multiple books, it's kind of hard to get them all together in one place. [...] I use them for my club sessions to discuss with my other friends, but the experience was, again, frustrating because I flipped through each individual page [of highlights] to find what I wanted." (**Sophia**)

In the case of Kindle users, to export and access the history of one's highlights from all books, they would have to plug their Kindle device to a computer and locate a text file hidden within a folder named "Documents". Even then, the text file is in a unique format, posing difficulties for lay users to handle and manipulate. Participants who use other applications also experience similar restriction when it comes to managing their metadata. **Quinn**, an experienced programmer, recalls preparing and parsing her metadata from the e-reading application Readera to participate in this field study.

> "I am trying to remember whether I can see all the quotes at the same time [on the app Readera]. **I don't think [I can] with the version that I have** because I just have the free version. I'm not sure whether I can see quotes from every single book [at once]. I was able to export it when I started the study for Quologue, but I had to just do a little bit of processing work in JavaScript to just parse out everything because I think it came out as a file that I could then turn into a JSON and then pull out the data from the JSON to turn it into that spreadsheet to import into Quologue." (**Quinn**)

The version of the e-reading application **Quinn** uses also did not support having a comprehensive view of her annotations. Also, in the process of making **Quinn**'s data more interactive and manipulate, there was a barrier which might have been hard to

overcome if the user was not already equipped with programming skills. These exemplify the limitations in their interface that act as obstacles to developing a collective awareness of their collections of e-books and annotations.

After the conclusion of the field study, 5 participants reported that they primarily interacted with Quologue through their mobile device, while 4 participants interacted through the web. One participant used both platforms equally. Next, I present findings that detail the trajectory of experiences participants had based on participants' accounts of living with Quologue throughout my field study.

4.2.1. Interacting with e-book metadata through the minimal design of keywords

4.2.1.1. Navigating interpretative ambiguities of keywords

Participants could access a new set of three keywords at the start of every Monday, and no other contextual information, such as the title of the book or the date of the highlight, were available on Quologue. Participants generally perceived keywords as an engaging way of surfacing their highlights that allows a room for interpretation. **Quinn** recalls that viewing the unexpected combination of keywords sparked a sense of curiosity:

> "I think [the keywords] made me **quite curious** because it caused me to really think and see if I could remember the quote, which I couldn't, but to think of **how might these keywords connect together into a response** that I want to submit? So sometimes there was a **surprise** because I'm like, "oh, [keywords like] 'birds,' or 'menagerie.'" I don't expect these keywords to be here, but I guess they must be related to the highlights I talked about. So, they would be important somehow." (**Quinn**)

While reflecting on the keywords she was given, **Quinn** inferred that the keywords would hold personal value, knowing that the keywords are generated from her highlight she had intentionally marked while reading e-books. This experience differed from encountering randomly generated output that had no association with her own data.

Keywords also triggered participants to have reflective experiences that might not be directly related to the actual highlight. In the following **Harper**'s example, the set of keywords reminded her of the struggles of Matthias, a character in the book she read.

> "The keywords [I interacted with] are 'craved,' 'pride,' and 'Matthias.' It took me back to the book that I read, and then I started thinking about what happened in the book that I read. And it got me kind of thinking about [the] traumatizing things that happened to this guy. I'm wondering if the highlight is supposed to be like, referring to the traumatizing things that have happened to him. [...] He was wrongfully imprisoned. So, what was he craving? Was it freedom? Was he crying over the possibilities of what could have been? So, it was honestly **really interesting for me to see the actual highlight, which had nothing to do with him being through horrible things**. (**Harper**)

Harper notes that after the source of the highlight was revealed, she noticed that it did not match her expectation on what the main content of the highlight is. Nonetheless, the initial absence of the contextual information on Quologue prompted her to have a thought-provoking reflection on the book, driven also by her recollections of reading it. However, there were also cases when the generated keywords did not accurately capture participants' authentic experience of the original text. Here, **Harper** expresses her frustration:

> "I remember reading a book recently, and I remember highlighting a big passage. And I wonder[ed] what keywords Quologue would [generate] if this was the highlight that I was being asked to guess. I wasn't really sure how I felt at that moment, but I think I was **a bit irked**. [...] I just felt like the keywords that were being given **don't reflect the actual spirit** or the point of it." (**Harper**)

While this was not a critical flaw in the system, it did pose challenges in an interpretative sense, highlighting the difficulty of aligning automated keywords with the nuanced understanding from their past reading experiences.

I also found tension in people's experiences when it required participants more effort and time to connect the keywords in their response when the keywords were not highly aligned in a semantic sense. Participants, however, rather appreciated how this led to thought-provoking experiences. For instance, **Suman** preferred when the sets of keywords were harder to connect compared to when the connections were more apparent to her at first viewing:

> "I feel like since [one of the keywords I saw] was such a random word, it **generated a lot more thought**. Whereas, if I had something that was like, "safety," "death," "courage," it's all related to one another. [...] They spark a lot more thought and more creativity. Whereas, when they're kind of all related, it's good, but in some scenarios, I kind of **want it to be more random**." (**Suman**)

Similarly, **Luna** points out that the times where the keywords left her confused at first ended up being more memorable to her than others.

> "I think I use keywords as more like means to an end. So, the ones that are **more memorable are** the ones that I was **most confused** about. [...] It was a challenge of putting keywords, like those tricky words, trying to put them together, even though they seemed completely unrelated." (**Luna**)

In summary, the minimal design of keywords acted as a key element in promoting engaging reflective experiences. Though some tension arose from participants' perception of certain keywords, in general, the minimal design of keywords provided space for participants to infuse their own interpretations, regardless of the alignment with their original reading of the text.

4.2.1.2. Uncovering creative potential in the use of keywords over time

In the earlier weeks of the study, I found similarities in participant's ways of making use of the keywords though there were no pre-made guidelines given to participants regarding how they should engage with the keywords. They expressed an interest in guessing which highlight or the book the keywords for the week are sourced from. In the following quote, **Luna** compares her interactions on Quologue to solving "puzzle[s]" where she uses the keywords as hints.

> "Every time [I saw the keywords], it was me trying to recall what kind of quote it was. It was almost like **a little puzzle**. It's like, [...] So I was like, I'm just curious to **see if I was correct**. [...] It was always interesting to see what the hidden quote was. Especially after I had some hints towards [what] it might be. So, it was confirming my guess was correct." (**Luna**)

Notably, I discovered that as participants approached later weeks of the study, they increasingly began to experiment with various creative ways of appropriating keywords. In the case of **Eric** and **Quinn**, they also started out in the first half of the study by guessing what their highlight might be through the keywords they received. The following excerpt is from a mid-interview where **Eric** describes that guessing the highlights with keywords acted as a way for him to become familiarized with the Quologue system.

> "This [response] was the first one. I was just guessing what the quote is from. I don't think I was being super creative. [...] I wasn't really reflecting too much on it. I was just doing like a **little test run trying**

> **to get into the mood**. [The next response] was getting **more speculative**. [...] I was also speculating more on what the words made me feel in that moment completely removed from the original quote." (**Eric**)

During the final interview, **Eric** recalls an instance of how he drew inspiration from his recent reading of another book in the latter half of the study. This inspiration influenced the manner he engaged with the keywords in the particular week, resulting in the creation of a short story.

> "My more recent [interaction is with] this one with "existed," "never," and "time." I sort of took those words and then wrote like a **very short speculative story**. [...] The reason I did this, I think, is **because I'm reading another book** right now, [which]] is *Terra Ignota* by Ada Palmer, [...] and that has a narrator with a very strong voice [...] who talks about what they're thinking, and you can really tell their personality through it. So, that might have inspired me to be like, "Okay, what if time never existed? Who's the type of person who would be saying that? How would they be writing this?" So, there I was **getting more experimental** I think with what these words could mean, where they'd be coming from, who would be saying it and less trying to guess what the original highlight was from." (**Eric**)

Quinn also went through a similar progression in her experiences with the keywords. She spent the first several weeks to test what the system generates based on her response as an input, and in this quote from the mid-interview, **Quinn** expresses her desire to experiment in her response for the later weeks:

> "I think in the latter half of the study, to be honest, what I want to do is **experiment more** with the system and say, "Okay, I'm going to put in this keyword that I don't think has anything to do with my annotations, and I'm going to make like a **totally far out response** that might not have anything to do with the original highlight because I want to see how the remix happens." So, I would like to experiment more." (**Quinn**)

In the final interview, **Quinn** followed up on her plan of experimenting more with the Quologue system. Here, she notes that she engaged with the keywords in more creative ways over time:

> "In the earlier weeks of the study, I think I was trying to match what I had highlighted [in my responses]. So, I really tried to consider what that hidden original quote was because I really wanted to try and respond as closely as possible to it. So, I think that was what I had in the beginning. Whereas, now **my responses became a bit more unhinged and creative**, where I consider less about the original highlight. [...] I'm just going to try and type in what comes to mind. So,

there was definitely **a lot more creativity in the later weeks**." (**Quinn**)

To sum up, there was a noticeable shift in participants' motivation in using the keywords. In the first several weeks, they were more likely to focus directly on the original highlight, striving to adhere to its intended meaning in writing their response. However, after they became more familiar with the system, they were increasingly guided by their sense of wonder and imagination, leading to their discovery of new creative ways to use keywords that were initially unclear or unknown. They started questioning how they could adopt new perspectives from the remnants of their digital highlights and what alternative forms of output they could produce instead.

4.2.2. A spectrum of reflective experiences triggered through Quologue

4.2.2.1. Quologue acting as a gateway for memory-oriented reflections

Throughout the study, participants shared descriptive vignettes of how Quologue mediated their memory-oriented reflections through revisiting their e-book highlights. These encompass a range of experiences from recent to more distant past experiences. For instance, **Eric** recalls that when the highlight was revealed, it triggered memories of his personal experiences from the past when he first created the highlight.

> "[Interacting with Quologue] reminded me of weirdly not the context of the passage and the book itself but **the context of my life**, while I was reading the book, like where I was, what I was doing. I don't think I could tell you exactly where I was sitting when I highlighted this, but I can tell you like the **stretch of time** that I was reading it. I was usually reading at work when there was downtime or on the bus to and from work. And I was working on some projects that had a lot of downtime. So, I could be reading more. And I was talking to my co-workers about this book. And so, there's a lot of like, moments in my life that are coming back to me, just from knowing that this is a highlight from the book, and the themes that it's discussing. So, it really influenced, I think, **my feelings and the way I went about my life** during that stretch of time. About resilience, **pushing through hard times**. Like realizing who you are. […] Which I think is similar to how I listen to music. […] whenever I hear a song from [my album], I'll be instantly transported to like the point that I was in my life when I was listening to it, and how I was feeling at that point." (**Eric**)

Interestingly, **Eric** compares the experience of revisiting his highlights as listening to music in his album, feeling instantly transported back to his past. Similar to

music, e-book highlights primarily seem to evoke his personal associations rather than being about one's direct creation of content such as photos.

In **Jackson**'s case, it was the date when the highlight was made helped him contextualize his personal experiences and the thematic elements associated with it during that specific period. After he notices that he made a certain highlight in 2022, he recounts,

> "[Quologue] also made me **think about what I was going through** then too. [Like, 'did I highlight] because I was going through some kind of events or life experiences that made me think about the particular highlight, or was it because the highlight is something that's generally good?' [I interacted with this quote:] 'the main issue is that carefully considering another's perspective is no guarantee that you'll be able to do it accurately.' This was **2022**. [...] I'm curious about why all of us have all these **personal and societal conflicts**. [And] because in 2022, there was a lot going on." (**Jackson**)

Sophia, on the other hand, used the interest of the week feature to incorporate the element from her recent past experience. In this quote, **Sophia** discusses how her recent visit to the botanical garden influenced her motivation behind putting the word "nature" for the interest of the week.

> "I went out to a botanical garden the weekend before, so nature was really on my mind for that week because I was just in awe of how beautiful the gardens were. [...] I kind of felt immersed in nature at the time, so that's why I kind of wrote it into my response on this one. [...] I think Quologue just incorporates something I did in real life and something I've done digitally like reading e-books." (**Sophia**)

Sophia's choice of the word, inspired by her recent experience, exemplifies how Quologue was used to connect participants' real-life experiences with their digital archive. By using this word in the response during the following week, she effectively bridged her physical experience with digital engagement. This integration is particularly noteworthy since as earlier accounts of participants' experiences with their existing e-reading applications show, their e-book archives often remain underutilized due to their limited interactivity.

Participants also had reflective experiences through their action of writing and interpreting the system output. For example, in this quote, **Nelly** describes the experience of encountering a parallel she found in the response she wrote and her highlight:

> "The keywords [I interacted with] are "lonely," "melancholy," and "sails." So, what I wrote was, "Like an abandoned sailor at the center of the blue pacific, he is doomed to a disheartening lonely sensation. The theme of his life is hollow melancholy and the only escape he's allowed is instant pleasure from his senses." [...] When I was writing this response, **I was very depressed, and it reflected on my life at the moment**. And then the highlight was, "Every time I experience the smell of the calm sails of a ship and the blue, wide-flowing river, I feel indescribably lonely, just like when I read Hoffmanstahl's poem 'Experience', and at the same time, the whispers of the emotional currents in my heart are flowing like the same melody as the Sumida River flowing under the fog." So, I thought that, again, I was incredibly blown away by how beautiful the writing of the highlight was. And I think it's interesting that the highlight and my response **both show an imagery of the ocean to describe the loneliness** [I felt]." (**Nelly**)

This quote shows that **Nelly** experienced layers of self-reflection by interacting with Quologue. First, through connecting the keywords into a response, she realized her response was representative of the emotional state at the moment. Then, she haphazardly discovered a similarity in the way her response and the highlight connect the words, which, in turn, enhanced her appreciation of the literary text she highlighted in the past. **Nelly**'s engagement was not merely with the text but with herself, catalyzed by the sequential components on Quologue that allow personal experiences to shape and be shaped by literary materials.

Similarly, **Quinn** remarks that the sequential experience on Quologue helps her slow down and reflect over an extended period of time, compared to traditional e-reading platforms.

> "I think it was just maybe like a good exercise to make you stop and think to maybe '**earn the quotes.**' [...] I think it goes back to that process of slowing down, reflecting, and making meaning. [...] You can pull up your annotations list and probably read the quote anywhere, but in this sense, this whole process of writing the response and thinking about the keywords, and then seeing the quote, **makes you slow down** and sit and think, 'Okay, what have I been reading? And how might this quote have taught me something for me to be able to respond in the way that I want to with the keywords?'" (**Quinn**)

These examples collectively show that participants engaged in interesting reflections on both recent and more distant past experiences, initiated by a range of different elements on Quologue. These included the revelation of the original highlighted text and its date or by selecting a word that primed the Quologue experience for the following week.

4.2.2.2. Reflecting on their e-book metadata and archive

Participants' reflections extended beyond personal memories, encompassing ones regarding their e-book metadata and the digital archive. This was often triggered by becoming aware of what they have forgotten or remembered since their first reading of the text when the original highlights were revealed. **Luna** describes her experience of revisiting her highlights and realizing that she had forgotten many highlights she created before.

> "I **realized how many quotes I just forgot**. [...] I think it ties into how, after you read a book, a lot of people talk about it in my book club, you forget a lot of the events that actually happened [which the club members talk about]. It's only when you reread, you're like, 'Oh, okay. Yeah, I kind of remember it.' [...] Like this one [where] a grandchild and his grandma reunite, and I **just completely forgot [about this part].** That's a really heartfelt and nice moment." (**Luna**)

She appreciated going back to the specific part from a book through her highlight, a moment that was stored in the archive but has not been revisited until she interacted with Quologue.

On the other hand, **Jackson**, who reported that he doesn't normally take the time to reflect on his highlights, mentions that he became more aware of his ability to remember the main ideas of what he has highlighted while interacting with Quologue.

> "I guess it was really cool to see **[when] my response was really similar to the highlight** because I **don't really think about those highlighted sentences [normally]**. But when I write something, using some of the words in the highlighted sentences, and what I wrote reconstructs or resembles the highlight, **I get a feeling that although I don't memorize everything that I read, they stick with me**. One, I thought it was really cool, but then again, it really depended on what I read. Because I think [with] the novels, [they] can be a little more random." (**Jackson**)

Although his responses were not, quite understandably, identical to the highlights, his responses mirrored the underlying idea of them at times. This left him an impression that the main ideas of what he marks as important continue to linger with him over time. Interestingly, he developed a sensitivity towards how different inputs influence outputs on Quologue, pointing out that this effect varied based on the type of books Quologue surfaced.

In **Eric**'s case, reading the original highlight alongside his response prompted him to interpret that the greater semantic difference between the two comes from the temporal gap between the present moment and the time when he first created the highlight.

> "I could see if these quotes [surfaced] immediately after I had highlighted something, [my response and the highlight] could be more similar because I could recognize the themes that I'm specifically thinking on at the time because I'm still thinking about them. But I think because of **how distanced I am from when I was highlighting these**, that's sort of where the more **drastic change comes in**. I'm not actively thinking about all this stuff anymore because I'm reading different things. I'm thinking about different themes." (**Eric**)

As participants interacted with their highlights surfaced from the archive, they noted that they began to develop specific ideas about their highlights. Here, **Quinn** reflects on her experience of forming stronger semantic associations with a certain vocabulary from her highlight.

"I guess in one of the e-books that I read, there are quite a lot of metaphors that are being used to try and talk about the things that the author is trying to express in terms of the knowledge he's trying to pass on. So, I actually just realized that's so interesting because then Quologue has made me think of how I have to use those nouns from the keywords in my responses. [...] For example, with this quote, it's made me think with regards to the keywords 'menagerie,' 'complex,' and 'stored,' which comes from the highlight. [...] So, now this makes me connect that word "menagerie" more towards that highlight and makes me think, 'Okay, well, now when I think of the word 'menagerie,' I **might have more associations with this idea of storing things inside our minds that we cannot let go of**.' (**Quinn**)

The interaction with Quologue, which spotlighted three keywords from her highlight and prompted her to connect them, facilitated deep engagement with the text and its nuances, resulting in the anchoring of an abstract concept.

Participants also inferred new insights about their personal e-book data by becoming aware of the pattern or similarities in the highlights they interacted with over the weeks. In this quote from a mid-interview, **Nelly** reflects on the discrepancy between the types of highlights she initially anticipated encountering on Quologue and the ones she actually interacted with.

> "I think I did **realize how serious my highlights can be**. Whenever I see the highlight that Quologue has chosen. There's not a lot of whimsical ones, and so the remix tends to be very serious. And I think it does reflect on my personality, but it **makes me want to highlight** quotes that are a little bit **more whimsical** as well." (**Nelly**)

Noticing that the highlights she interacted on Quologue tend to have a serious tone, **Nelly** wishes to leave more digital traces that could show more underrepresented part of her personality. **Nelly**'s quote hints that reconnecting with one's e-book metadata could potentially influence the way they currently annotate on e-books. In the next theme, I discuss this in more detail.

4.2.3. Changes in e-reading practices and perceptions of generative AI

4.2.3.1. Shifting digital highlighting practices

After spending weeks of interacting with their e-book highlights on Quologue, participants generally shared that they have become more thoughtful and strategic in the way they highlight after interacting with Quologue. For instance, in the mid-interview, **Suman** reflected on a change in her approach to highlighting:

> "I feel like I value highlights a lot more than I previously did. Whereas before, I would just kind of highlight things, and then I would look back and think to myself, "why did I highlight that?" So, it's kind of changed in that way. Whereas now, I'm **more mindful**. [...] It felt like [previously,] I was highlighting every single quote that I came by. And a lot of them were quotes that were important in the context of the book but not the way that it was written." (**Suman**)

During the study, Suman noticed a pattern in her highlights that many of her highlights are valuable in the context of the book but not in and of themselves, which was not apparent to her prior to this study. This sentiment persisted through the latter half of the study. In the final interview, **Suman** shared a specific anecdote from when she was reading another e-book, during which she noticed changes in her highlighting behaviors.

> "The other day, I was using a Kindle, and I was reading. I guess that thought kind of crossed my mind, as I was about to highlight something. But then, I realized how **useless** the quote was, and I **ended up not highlighting it and highlighting something else**. I'm also just **making the quotes a bit longer,** too. I noticed that helps a lot because it gives **more context** to the quote." (**Suman**)

When highlights are exported from their usual e-reading service to external software such as Quologue, the context of the highlight is no longer directly available. It shows that **Suman** adapted to this change by a new strategy where she highlights longer parts of a passage than usual to include more context when she revisits these in the future.

Similarly, in the following quote, **Quinn** mentions that she would consider the relations between different highlights, which she admits to not considering prior to living with Quologue:

> "If I was to reread [books] again, after using Quologue, then I would definitely **have a different perspective of thinking about maybe the relations** I have between the different quotes that I'm highlighting, which I **haven't really thought of before**. [...] Maybe then I would just be **more mindful of what I am highlighting** and more interested in thinking of, 'what are these different types of quotes that are there in this book that might have some sort of lesson or some sort of information?'" (**Quinn**)

Nelly also notes that there was a shift in her attitude from a more casual to more purpose-driven when it comes to highlighting.

> "Now when I read e-books and make highlights, sometimes I think about how this could be utilized in the app. So, sometimes I get **pickier** with the quotes that I highlight. Also, sometimes I highlight quotes that have really beautiful phrases that might make it in the **remix** of Quologue. [...] I feel **more attentive** to the highlights I make. There's more of a purpose behind it. Instead of it being like, 'oh, there's a nice quote.'" (**Nelly**)

These narratives show that as participants lived with the Quologue system over the weeks, it influenced their current e-reading practice. This was evident in their highlighting behaviors—both in what they choose to highlight and how they approach the task. These changes adapted to the context of a repurposed system where they could engage in more creative interactions with their personal metadata.

4.2.3.2. Renewed perspectives on creative uses of generative AI and personal e-book data

In this section, I discuss how participants' perspective on creative uses of GAI and their personal e-book data have changed after living with Quologue. **Nelly**, for instance,

remarks that she perceived the GAI model on Quologue as a collaborative partner that enhances human creativity rather than replacing it:

> "I think before [interacting with Quologue] when I heard about how GAI is going to take over artists and writers, I had a negative view on that. I thought that that was taking away creativity. But I think this **fosters more creativity**. And so now I have a **more positive** view on GAI being involved in the arts. [...] It's not really that the GAI doesn't have a **sense of yourself** because, for example, for Quologue, [in] the remix, there's definitely **a sense of myself** and my ideas in it. So, it's not that my creativity is taken away. It's more that it's being **heightened**." (**Nelly**)

Nelly's anecdote exemplifies the personalized nature of the Quologue experience, which allowed her to imbue "a sense of [herself]" in the outputs generated. Through different steps within the sequential interaction, i.e., surfacing her personal metadata and inputting her response to the keywords, participants made use of the opportunities to incorporate personal elements in the output.

Similar to **Nelly**, **Suman** also shared that she was initially opposed to involving AI for creative tasks as an aspiring writer. However, as she used the writing process on Quologue as a way to brainstorm ideas and afterwards compared the remix and her response, she came to believe that GAI could complement her own creativity.

> "I think, **at first, I was kind of against AI** in a way because I thought, "oh, it takes away from your creativity, takes on a different personality, and stuff. But then, I started to realize, it actually helps **summariz[ing]** a lot and helps in the writing process if you keep iterating on it. [...] I feel like it helps a lot when you're **brainstorming**. [...] I think it just helped me to **build my personality as a writer in terms of writing**." (**Suman**)

In addition to the changes in participants' perspectives of GAI, leveraging GAI as a lens to mediate their interactions with their e-book archive have also reshaped the potentialities of their personal data. Specifically, they have started to envision more concrete ways of how their data can be transformed into materials for various creative purposes. Here, **Eric** compares his usual e-reading experience on Kobo and discusses how interacting with Quologue have uncovered how he could use his e-book data to support introspection.

> "Mainly just going back to these highlights makes me want to think [like,] 'Okay, what else can we do with this?' Because just the base features that you've got on a Kobo are like the first things that you

> would think of. But if you've got the data, and you can use it to do stuff like this, **what else can you do with them**? What are the other possibilities? I didn't even know that [Kobo] saved the date that you made the highlight. Like, can you have [features] like, 'here's what you were highlighting last year,' type of thing. [...] 'What kind of a different person were you to be highlighting this type of stuff? Or, are you the same? Would you feel the same way about them now?' [...] Basically, all that data is stor[ed] so that when I go into my highlights record for that book, it can show me where they are in the book and the time that they were highlighted. But just using that and being able to apply it to something that's really different, like Quologue, did **make me think about the other opportunities** that you've got with even those little bits of information. Like, '**what else can you do with them that your e-reader isn't doing**?' It's still storing that data for a specific reason, but it's not using it in this way, even though it definitely could." (**Eric**)

Eric's reflection harkens back to participants' general perception of existing e-reading services, which was explored earlier. Due to the limitations in interactive capabilities common in these platforms, **Eric** was unaware that his Kobo stores the date when he created highlights. He only discovered this after seeing this type of data on Quologue.

He now believes that his e-reader could go beyond basic features, such as mere storage and retrieval of highlights, while suggesting more speculative ways of using his highlights as viable material for him to reflect on changes in his identity in accordance with temporal changes.

Patrick also shares the shift in his attitude, now viewing his e-book metadata as dynamic elements that can be transformed into remixes, images, and videos.

> "I think before using Quologue, I felt like highlighting is just doing some action. [...] But after using Quologue, I think, with the highlights, I can make remixes, or I **can make images**. Or, I can **make some videos with the AI**. [...] So, yeah, it **totally changed my way of thinking in terms of the highlights data**." (**Patrick**)

Collectively, through the Quologue design, as participants' data managed by different proprietary e-reading services is repurposed for self-reflection and creative expression, participants gradually discovered new ways of leveraging ambiguous traces from their e-book metadata for their own context throughout the study. This also heightened their awareness of creative possibilities with GAI and personal data.

4.3. Discussion

4.3.1. Reclaiming personal data through appropriating proprietary systems

Prior works in HCI have documented the value of designing products and systems that accommodate users to appropriate them in ways other than the original design intent [15, 36, 82, 144]. Kinnee et al. [70] shed light on the potential value of appropriating proprietary system that collects and manages personal data through their work of speculating on how home IoT data collected through Amazon voice assistants could be repurposed for the inhabitant who produces the data. Their work illustrates that the processing and reworking of one's own data can help reveal formerly unrecognized possibilities within the data and to imagine alternative futures. While this aspect of designing for appropriation and 'breaking data free' [138] was central in my work, I was also interested in exploring how rebuilding digital systems that are open to users' interpretation can also introduce or augment ludic qualities [49, 59, 106] in the design.

As I discovered from the beginning of my study, various e-reading services currently available on the market, e.g., Kindle, Kobo, Readera, are not equipped with features that allow users to easily export or manipulate their highlights. For instance, in Sophia's case, her Kindle made it difficult for her to revisit her highlights for reading club sessions. These restrictions imposed by e-reading services may be attributed to digital rights management infrastructure that provides conditional access to these e-book data [2]. However, as its side effect, these restrictions create barriers for e-book users to develop an awareness of what data are stored or how they could potentially make use of them through repeated engagement.

This was demonstrated during the earlier weeks of the study when participants engaged with the keywords in a more straightforward way, i.e., to guess the book or the highlight the keywords were sourced from, as shown through **Luna**, **Eric**, and **Quinn**'s anecdotes in 4.2.1.2. As participants became more familiarized with the Quologue system, they began to implement more elaborate and playful ways to appropriate their data and our system, which we, the design research team, did not anticipate in the beginning. In the latter half of the study, **Quinn**, for example, experimented with out-of-the-box responses with the hope of producing an interesting remix, and **Suman** used

Quologue as a tool to brainstorm and to hone her own creative writing skills. Though these behaviors gradually emerged based on each participant's desires and context over time, they signaled a significant shift. Interacting with this new kind of application enabled participants to discover their agency regarding their e-book data. Consequently, their role shifted passive users who have highly limited control on their own data to active producers who are more familiar with appropriating the data for their personal context.

These findings suggest that there are clear opportunities to mobilize personal metadata managed by proprietary infrastructure for users who produce them. In a quote from 4.2.3.2., **Eric** imagines how his data, collected and managed by e-reading services like Kobo, could rather be repurposed for alternative uses such as introspection. This sheds light on the value of a "middle" infrastructure that could open the avenue for end users to easily experiment with their data that were previously hard to manage or manipulate and start wondering about alternative forms of technologies that better fit their various needs. In *What Things Do* [129], Verbeek extends a postphenomenological perspective to contend that technologies exercise a prescriptive force over their users, akin to the role of actors in a network. According to this perspective, technologies are far from neutral elements to their users, as they have the capacity to dictate their users' behaviors, thereby shaping the relationships between technologies and the users. This perspective raises new questions for the design of new systems that invite users to actively discover alternative ways of making use of their own personal data. In what ways can GAI models be mobilized as design resources to facilitate users' interactions with their own data and help reclaim it? What could or should the designer's role be in responsibly building systems that are open to appropriation? How should the relationships between designers and users be managed as new creative ways of appropriating such systems as they are gradually uncovered?

There is an inherent concern in designing interactive systems for appropriation as it requires "plan[ning] for the unexpected" [36]. Höök [55] also argues that there is a need to balance a designer's role in allowing some room for users appropriate their technology for their needs while not assuming that users can always find potential ways of appropriation on their own. There is a need for future HCI research to investigate how these acts of appropriation of new systems that make use of personal data could be further supported socially. According to Dix's guidelines on designing for appropriation

[36], systems could be designed to rather encourage sharing different ways of how users appropriate a given system, thereby allowing users to potentially learn from the exchanges of ideas. In this process, instead of handing over all control to a group of end users, designers can also intervene by supporting future appropriations as well. For instance, drawing from the framework of meta-design [43], designers can analyze the common appropriations of the system and iteratively build new GAI components in the system that facilitate those use cases. This could potentially help the system evolve with users to support typical ways of how users engage with their data.

4.3.2. Designing alternative forms of LLMs for slow interactions

My findings suggest that there is a need for HCI community to probe the potential of LLMs as design resources for slow interactions. Based on participants' narratives of living with Quologue, I discovered that two key factors in the design shaped their reflective experiences: *ambiguous traces* and *sequential unfolding*.

First, I aimed to remove the original context of users' highlights and generate low-granular text output to allow active meaning-making experiences. This strategy of encouraging reflections for the end users through low-granular output has been in employed in many slow technology artifacts, particularly in those involving digital photos, videos, and music listening histories. Artifacts such as CrescendoMessage [126], PhotoClock [19], and Affector [9], blur or apply filters to pixels to encourage open-ended interpretations. Also, Olly [96] and Olo Radio [90] have explored producing "low-granularity" output for music listening histories by limiting the context available in terms of when and where in the past a song surfaced from. In the case of LLM systems, a chatbot format is commonly used that takes on more dialogue-like interactions. Though this interaction tactic can be effective for mirroring natural conversations, the approach of using ambiguity as a design resource for LLM systems has not yet been highly mobilized. I adapted this approach for my context by displaying only a set of three keywords at the start of a week without revealing the entire highlight. This method diverges from the more commonly used chatbot format by initially veiling users' previous engagements with the text, and this minimal design of Quologue played a key role in encouraging deeper engagement with their metadata.

Interestingly, I discovered some tension in participants' reception of this design element. As **Harper**'s reflection in 4.2.1.1. shows, the keywords occasionally fell short of encapsulating the nuances of the original writing that the participants subjectively experienced. This can be attributed to the nature of e-book highlights data that lacks the surrounding context. Nevertheless, it was common that the minimal presentation of keywords also piqued participants' curiosity and led to thoughtful reflections. The low-granular nature of the keywords was critical in provoking more thought regarding the text and the readers themselves. As illustrated by **Suman** and **Luna**'s accounts in 4.2.1.1., participants sometimes encountered keywords that were seemingly unrelated at first glance, which creates a challenge that could be considered a design flaw in a conventional sense. However, through their attempts to establish new connections between these keywords, the interactions with past e-book highlights became more memorable, engaging, or fascinating.

Second, the Quologue system enabled participants to have deeper engagement with a single highlight from their archive through an extended period of *sequential unfolding*. After encountering the *ambiguous traces*, participants initially attempted to resolve the tension by engaging in active meaning-making experience through a written reflection using the keywords, e.g., by writing a short story, guessing the highlight, expressing one's current emotional state. Then, after the source of the keywords gets revealed, regardless of how similar their response is to the highlight, it triggered a range of interesting reflections. When **Jackson** perceived similarities between his response and the highlight, he interpreted it as an indication of the main essence of these metadata still lingers despite his previous lack of awareness. In **Luna**'s case, when she was presented with unexpected highlights, it made her realize how much she has forgotten about these metadata. Additionally, remixes, at times, retained personal elements, which were perceived as more expressive of one's personal identity (see **Nelly**'s example in 4.2.3.2.). In my study, I demonstrated various ways by which LLMs could mediate the reengagement with one's digital traces through a stepwise journey. There exist opportunities to extend this research area by exploring more speculative formats of involving LLMs in digital systems.

Recently, HCI researchers have paid much attention to explainable AI with the aim of building AI that is more manageable and manipulable by making the inner mechanism of AI more accessible to users [75, 76, 140]. While these works are valuable

for enhancing trust and transparency in AI systems [123, 134], there is also a growing body of works that explore the alternative potentialities of AI systems by highlighting the mysterious, ineffable qualities of the output. These efforts include creating a tarot card deck with GAI [78], making a design probe for visualizing dreams with GAI [10], using an LLM "hallucination" for visual storytelling [54], and playfully reproducing one's images through generative adversarial network (GAN) techniques [6]. These works encourage users to have open-ended interpretations of AI outputs. However, leveraging LLMs as tools for navigating personal digital archives to promote rich reflective experiences is surprisingly underexplored. Most existing slow technology artifacts [90, 94, 126, 136] have largely examined ways to effectively surface one's metadata from large digital archives, but I envision a novel way of co-creating with an LLM as a way of reconnecting with one's digital past in addition to simply revisiting it. Since LLM, or GAI more in general, can take direct input from users, future research can further explore designing ways to bridge one's recent experiences with the digital past, as illustrated through how **Sophia** (4.2.2.1) and **Eric** (4.2.1.2.) appropriated Quologue. For instance, it is possible to experiment with recreating one's personal data through different tones such as symbolic, poetic, surreal, or exaggerated language with varying levels of granularity to trigger rich introspection.

Another potential design space is to explore using LLMs for an alternative representation of time with the help of temporal metadata. As shown in 4.2.2.2., **Eric** notes that he used the temporal metadata and the semantic difference from his response and the original highlight to infer the time passed since he made the highlight, hints at another potential design space. As prior works have illustrated that temporal metadata in digital systems can help people frame and interpret personal data [52, 98], HCI researchers can extend this by imagining in what different ways LLMs can help engage in meaning-making experience with one's temporal metadata. For instance, it is possible to envision *semantic patina*, a feature within LLM systems that gradually alters the original textual metadata over time. Unlike the widespread implementation of LLM systems that require direct user involvement, this feature could operate in the background and potentially serve as a more subtle, indirect indication of the temporal gap between one's past and the present. However, clearly in a such a potential future of using LLM systems for reflective experiences, it would be also to address issues such as balancing system autonomy and user control.

4.3.3. Reimagining digital practices involving personal metadata with new affordances

At the end of my study, participants reported on changes in their e-reading practices. Especially, it was a common experience among participants to become more sensitive and meticulous with their input in the Quologue system. This included becoming more mindful of what they highlight on e-books and including more context in their new highlights. **Quinn** also reported that, after using Quologue, she would focus more on the pattern in different highlights she makes, which is a perspective she has not considered previously. In **Nelly**'s case (4.2.3.1), after weeks of interacting with Quologue, her motivation for highlighting became mixed with the anticipation of what output she might create through the Quologue system. Knowing that she has the agency to use the highlights as creative materials in the future, her role in highlighting now resembled the role of an active curator rather than a passive reader. In both **Quinn** and **Nelly**'s examples from 4.2.3.1., highlighting became a more deliberate practice that could be linked with specific future actions, similar to how a curator prepares a collection of pieces that could be engaged in a new context in the future.

Surfacing e-book highlights through Quologue also clearly influenced participants' perception of what their kind of data are stored in their archive. **Nelly**, for instance, was able to identify a pattern in the surfaced highlights. Regardless of whether the experiences with her highlights on Quologue during this study encompassed the entire extent of her highlights archive or not, her new perception of it also led to desiring to change the future digital reading practice so that the collection of her highlights is more representative of her. Although my method of surfacing digital highlights was through random selection, this raises issues for the potential impact of GAI playing a larger role in mediating my interactions with personal data archives. Prior works have explored how interacting with GAI could shape the way we perceive reality [5, 6]; however, their effect on my perception of digital identities based on the extensive records within personal metadata archives is yet to be explored.

It is clear that participants have discovered new affordances of e-book metadata when it was paired with GAI, as shown through many instances of participants making highlights for future actions in mind. My findings open an interesting avenue for research from an "affordance-orientated" approach which posits that people's perceived

affordances of digital possessions affect their valuation of their digital possessions [25]. According to this approach, there may be a potential interplay between one's high-level motivation and their augmented interactions with e-book annotations on their valuation of e-books. To illustrate, a user who values expressing themselves more than another user who does not might be willing to experiment more and discover various new ways to use their e-book annotations to support their high-level motivation to express themselves. This could, in turn, create discrepancies in how much they end up valuing their e-books or e-book data. This issue is particularly relevant for e-books since they lack the visibility in people's daily lives that physical books have, which leads to people having a reduced sense of ownership and personal value attribution towards e-books [50].

The research project presented in this thesis offers a contribution of envisioning dynamic e-reading services that are equipped with a wider range of GAI affordances to satisfy users' formerly unrealized motivations. Building on previous works on reimagining the practice of digital reading [35, 80, 81], my work contributes to conceptualizing e-books and e-readers not as mere digital replicas of physical books but as vehicles for reconfigurable reading experiences that transcend the affordances of paper.

4.4. Conclusion

Through the deployment of Quologue to 10 participants for eight weeks, I discovered that Quologue was effective in mediating reflective experiences through people's e-book highlights. My contribution lies in offering insights on designing alternative forms of incorporating GAI in a system to encourage open-ended interpretations. I also analyzed the ways in which living with this new type of GAI system for personal e-book data have influenced people's current digital reading practice and helped envision future potentialities of their data and practice.

Chapter 5.

Conclusion

The contribution of my research is twofold. Firstly, through a research-through-design and autobiographical design process, my study examined the reflective potentials of e-book metadata—a surprisingly underexplored source of personal metadata. This phase highlighted the challenge of working with GAI as a design material, such as re-evaluating initial expectations of GAI and making compromises in the process. The documentation of my living with the prototype system illustrates how the design of Quologue effectively triggered interesting reflections, making e-book metadata more interactive and manipulable.

In the field study, the second phase of my research project, I discovered that participants, who lived with Quologue for eight weeks, were also able to engage in similar reflective experiences, using their own e-book data. After adjusting to the novel design, they adapted their interactions by developing new unique strategies that utilized Quologue to engage with their digital past. These experiences underscore that there is a clear need for the design of systems that invite users to reengage and gradually discover new ways of interacting with their personal data.

To address the common fundamental limitations of proprietary infrastructure that manage and control these data, my work on Quologue serves a design case for using GAI, LLM in particular, to surface past digital traces from personal metadata archive for reflective experiences. Through the design and deployment of Quologue, I advocate for more alternative and speculative ways for re-engaging with personal data archives, promoting rich reflections over a long period of use.

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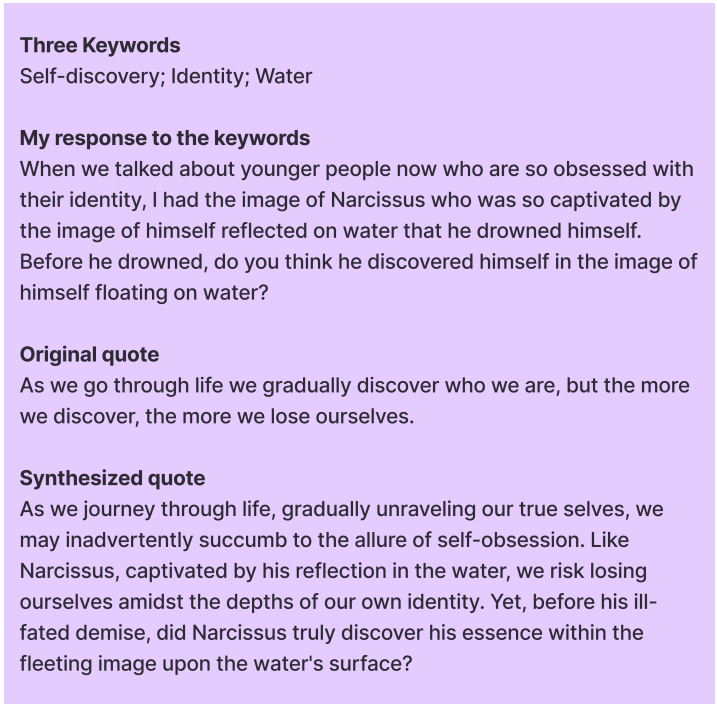
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Appendix A. Additional diary entries

Figure A.1. Diary entry from July 19, 2023

This diary entry shows how I added a new allegory based on the random keyword that was not present in the original quote. The keyword “water” was, in fact, randomly generated based on the requirements in the prompt and was not related to the original quote (see 3.1 for more details on these requirements). When I encountered the keyword “water” with the other two keywords “self-discovery” and “identity,” I contextualized the keyword “water” by conjuring up the image of Narcissus who drowned in water by being captivated by the image of himself reflected on water. The random output from the GPT-3.5 model inspired me to come up with the new allegory of Narcissus which was coherent to the theme of the original quote and added an interesting layer of meaning in the synthesized quote.



Three Keywords
Self-discovery; Identity; Water

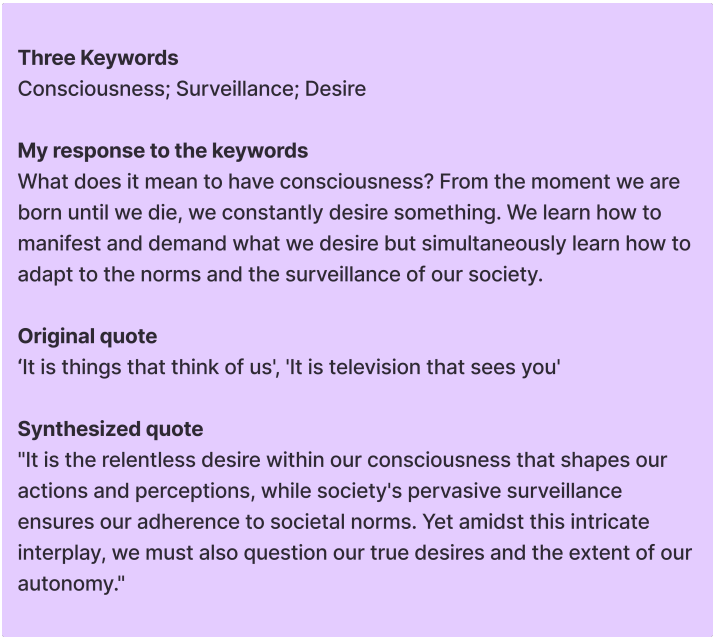
My response to the keywords
When we talked about younger people now who are so obsessed with their identity, I had the image of Narcissus who was so captivated by the image of himself reflected on water that he drowned himself. Before he drowned, do you think he discovered himself in the image of himself floating on water?

Original quote
As we go through life we gradually discover who we are, but the more we discover, the more we lose ourselves.

Synthesized quote
As we journey through life, gradually unraveling our true selves, we may inadvertently succumb to the allure of self-obsession. Like Narcissus, captivated by his reflection in the water, we risk losing ourselves amidst the depths of our own identity. Yet, before his ill-fated demise, did Narcissus truly discover his essence within the fleeting image upon the water's surface?

Figure A.2. Diary entry from July 13, 2023

When I prompted the GPT model to generate keywords from my highlight that said, “[i]t is things that think of us, [i]t is television that sees you,” the GPT model listed “surveillance” as one of the keywords. The original quote did not explicitly include any synonym or words that are semantically related to “surveillance”, but the model still identified the paranoia of the character in the book towards the objects. These interactions, along with several similar instances also listed in Appendix D, let me gather that the model performed well at detecting high-level themes in a given quote.



Three Keywords
Consciousness; Surveillance; Desire

My response to the keywords
What does it mean to have consciousness? From the moment we are born until we die, we constantly desire something. We learn how to manifest and demand what we desire but simultaneously learn how to adapt to the norms and the surveillance of our society.

Original quote
‘It is things that think of us', 'It is television that sees you'

Synthesized quote
"It is the relentless desire within our consciousness that shapes our actions and perceptions, while society's pervasive surveillance ensures our adherence to societal norms. Yet amidst this intricate interplay, we must also question our true desires and the extent of our autonomy."

Appendix B. GPT explorations: Testing its capability of high-level theme analysis

Can you identify some key themes based on the semantic information of a quote?

Yes, as a language model, I can identify some key themes based on the semantic information of a quote. Semantic analysis involves understanding the meaning behind words and sentences, and can help identify the underlying themes and messages conveyed by a quote.

Here is an example of how I might identify some key themes based on the semantic information of a quote:

Quote: "The only way to do great work is to love what you do."

Key themes:

1. Passion: The quote emphasizes the importance of having a deep and genuine love for one's work. This suggests that passion is a key driver of success and achievement.
2. Motivation: The quote suggests that love for one's work is a crucial factor in motivation. When people are passionate about what they do, they are more likely to be driven to succeed and achieve their goals.
3. Excellence: The quote implies that great work can only be achieved by those who are deeply committed to their craft. This suggests that dedication and hard work are essential for achieving excellence.
4. Fulfillment: The quote suggests that finding work that one loves can lead to a sense of fulfillment and satisfaction in life. This implies that work can be more than just a means of making a living, but can also be a source of personal fulfillment and meaning.

Overall, the quote suggests that passion and dedication are key factors in achieving success and fulfillment in one's work.

Identify two key themes in this quote: "In truth, the dramatics of a life-determining experience are often unbelievably soft."

Sure, here are two key themes in the quote "In truth, the dramatics of a life-determining experience are often unbelievably soft":

1. Subtlety: The quote emphasizes that life-determining experiences are often not as dramatic as we might expect them to be. Instead, they can be soft and subtle, suggesting that important moments in our lives may not always be immediately recognizable.
2. Perspective: The quote also implies that our perception of what constitutes a life-determining experience may be flawed. It suggests that we may be expecting something more dramatic or obvious, when in fact, the most important moments in our lives may be quieter and less noticeable. This theme encourages us to consider the importance of a broad perspective and to be open to the possibility that significant moments in our lives may come in unexpected forms.

Appendix C. Early-stage wireframes of Quologue

