



Design Documentation

Crumbz



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Introduction

01. Project Overview
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03. Research Overview

Project Overview

Couples in multilingual relationships often seek to learn each other's languages to better understand and connect with one another. However, the current approach to language learning—focused on improving vocabulary, grammar, and generic language usage for better test scores—doesn't align with the primary interests of our user group. They are more interested in enhancing their ability to communicate with their partner's family and friends, which often involves understanding specific topics relevant to family dynamics and culturenuances. Rather than aiming to write a perfect essay, they want to share jokes, celebrate joyful moments, and engage more meaningfully with their partner, family, and friends.

Through our research, we found that partners are uniquely positioned to facilitate organic language learning. They naturally create opportunities through conversations with family and friends that are highly relevant and meaningful. This is where we step in to truly leverage these moments, transforming them into personalized language learning experiences that resonate with our users' needs.

The project team, consisting of four ESL speakers, drew from our own language-learning experiences and identified a curiosity zone: what does language learning look like when one person is trying to learn the native language of their loved ones? We believe the unique dynamics of multilingual romantic relationships present both opportunities and challenges for language learners. This motivated us to explore and design an enhanced language learning experience tailored to these specific situations.

Research Overview

■ Introduction

In this research, we explored how multilingual romantic relationships impact language learning, focusing on relationship factors that influence learning experiences and outcomes. Our findings from the spring quarter laid the foundation for our summer quarter design phase. These insights guided us in setting specific goals for our target users—individuals in multilingual romantic relationships.

■ Methods

We conducted a semi-structured dyadic interview with 16 participants (8 dyads). Each dyad consisted of a learner and their partner.

Each interview session was 60-90 minutes long. The goal of the interview was to collect data on participants' language learning, their multilingual relationships, and how the two interplay.

■ Top Findings

- 01.** The partners complement the learners' primary learning material by providing social, cultural, and situational contexts for language usage.
- 02.** Learning partners' language deepens the connection of couples by facilitating moments of delight and memorable interactions in their relationship.
- 03.** Learners learn the language to communicate with their partners' parents and to build a deeper connection with them through learning about their culture.
- 04.** Learners highly value immersion for effective language learning, and their partners are favorably and uniquely positioned to provide an organic immersive environment.
- 05.** The partners support the learners by creating an emotionally safe and judgment-free space.

■ Design Implications

We proposed a How-Might-We question to guide our design:

How might we facilitate language learning for individuals learning their partners' native languages so that the couples feel more connected through the learning experience?

Introduction of Crumbz

**Chat, Capture, Connect -
Turn Moments into Language Learning**



“

“The premise is very simple, but in my opinion, very effective and very based on how I learn in real life... And it's like almost creating a personalized lesson for myself” - P4

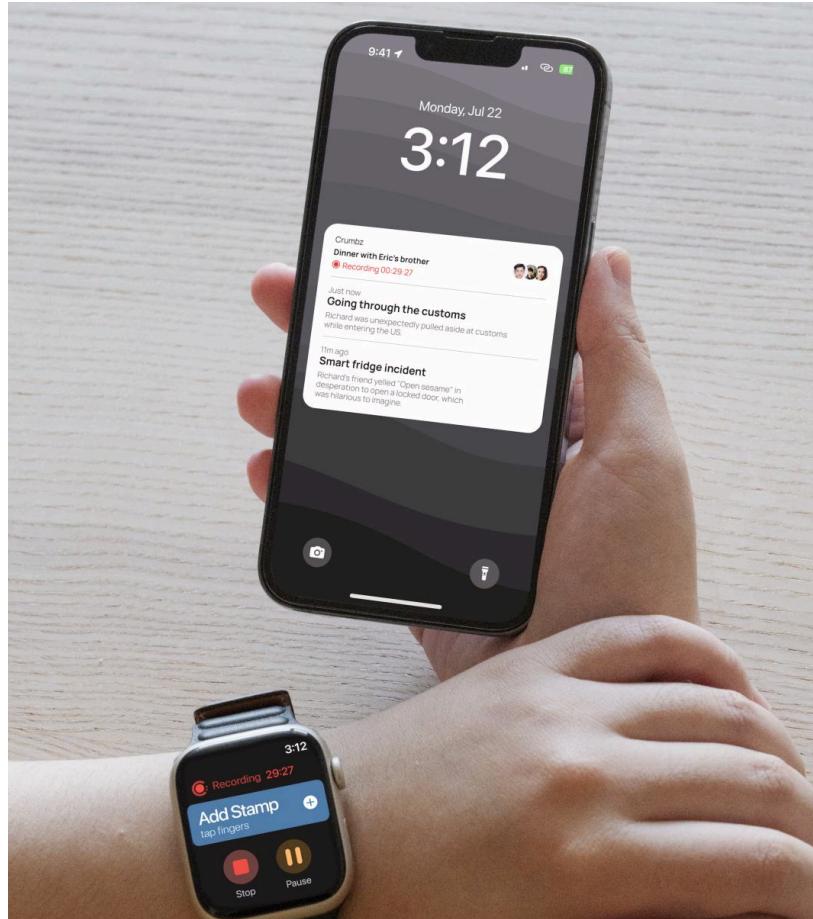
”

Our research shows that language learners greatly value immersion for effective learning, and their partners are uniquely positioned to create this organic environment. Crumbz steps in to harness these moments, transforming them into personalized language learning experiences.

Crumbz is an interactive memory log that helps language learners in multilingual relationships to effortlessly capture, review, and learn their partners' native language from their conversations and cultural experiences.

Introduction of Crumbz

Crumbz leverages everyday interactions between couples and their families or friends, transforming delightful moments into personalized language learning experiences through Conversation Capture, Learning Cards, and Dialogue Review.



■ Conversation Capture

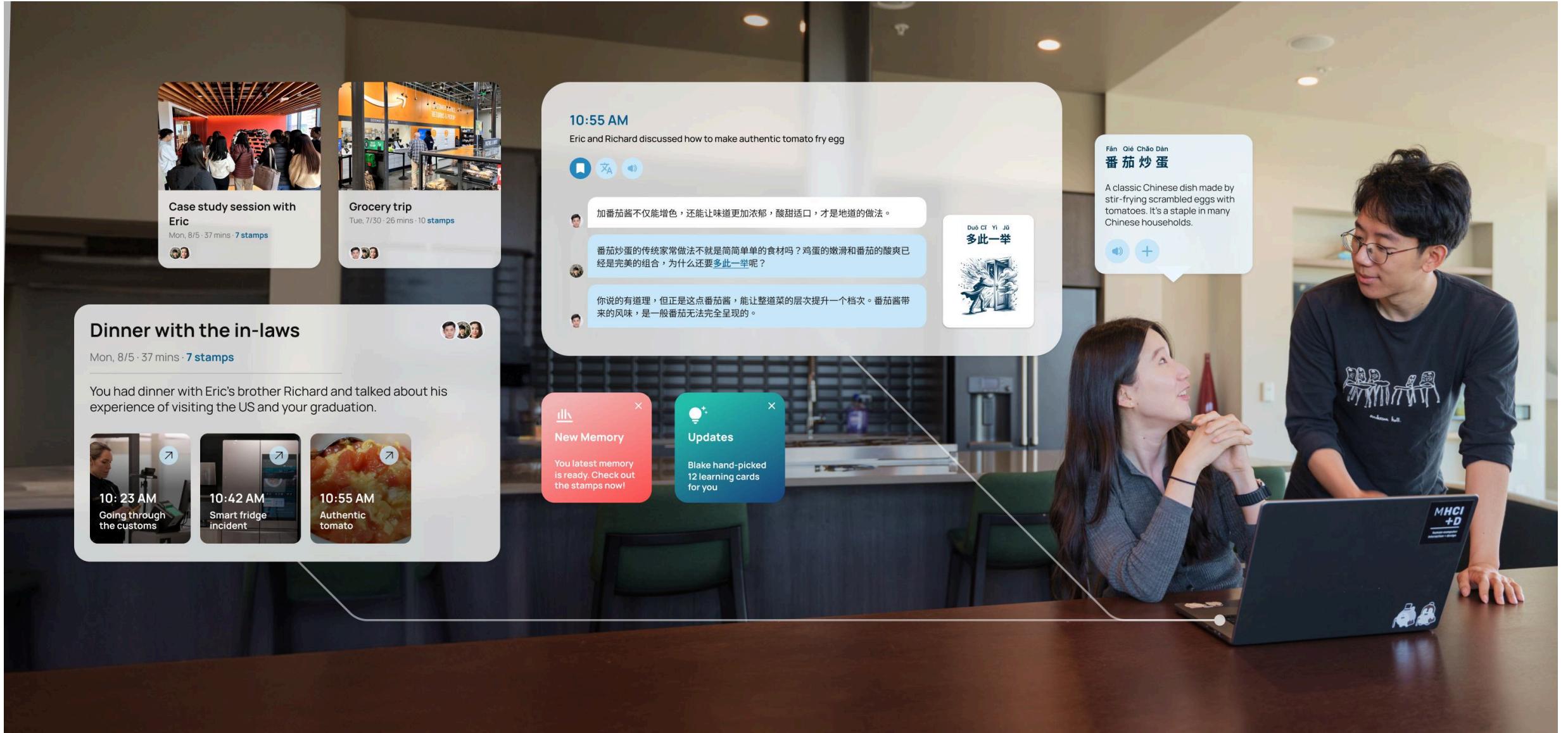
Conversation Capture is designed to seamlessly integrate language learning into daily interactions. It allows users to record conversations in real-time through a simple gesture on their smartwatches without interrupting the flow of dialogue. Crumbz respects privacy by notifying other participants in the conversation and providing an opt-out option. When recording, users can create timestamps for words or phrases they find challenging, learning from the parts they didn't understand.



■ Learning Cards

Crumbz generates learning cards from conversations that include vocabulary, cultural context, and more. This enables users to revisit and study specific parts of the conversation, enhancing their language skills through accessible, bite-size materials derived from their own moments. Partners can participate in the learning by adding personal insights and cultural nuances to the material, enriching the learning experience and deepening the connection.

Introduction of Crumbz



■ Dialogue Review

Users can learn from their conversation in a more structured way by reviewing dialogue on their large screen devices. The desktop version of Crumbz provides a comprehensive view of both the text and its audio translation. It is organized by timestamps and topics, making it easy to navigate through specific sections. Crumbz enables users to efficiently review and study the content, reinforcing the learning.



Design Process

01. Design Principles
02. Ideation
03. Down-selection
04. Lo-Fi Prototyping
05. Iteration

Design Principles

Based on insights from our secondary and primary research, we have developed design principles to guide our final design. By adhering to these principles, we aim to create a holistic and enriching learning experience that strengthens multilingual couples' relationships.

■ Building Safe Space

Foster an atmosphere where learners feel comfortable and mistakes are seen as natural parts of the learning process.

■ Fostering Connections

Deepen meaningful emotional and cultural connections between learners, partners, and partners' families.

■ Celebrating Delightful Moments

Create positive associations with language learning, introducing joy and meaning in memorable moments and everyday life.

Ideation

In our ideation phase, we came up with about 40 different ideas and evaluated them against our core design principles. Although none of the ideas were chosen as a whole, the process was crucial in identifying valuable elements that shaped our final concept. We pulled together aspects like form factor, key interactions, and content of the learning material .

We liked the form factor of an interactive textbook, and we liked the idea of a shared memory journal as we wanted our the content of the learning material to be generated from the shared memory of the couple. We also wanted to leverage everyday conversations as the main medium, and lastly we wanted the interaction to be a process of decoding conversations as a method of learning. So these aspects from different ideas became the building blocks of our design.



Form

- Personalized interactive textbook catered to the learner's skills and everyday language needs

Content

- Shared memory journal in the form of an album or story book

Immersive experience that simulates the feeling of being in a different language environment

Medium

- Digital pet that acts as a conversation practice partner

Bilingual social media feed serving as a cross-cultural trend and meme platform

Interaction

- Encoded love letter providing an analogue alternative to digital communication

Gamified language learning experiences requiring the couple to collaborate on language and cultural puzzles

Final Concept



Our final design is an interactive memory log that lets learners capture conversations, add timestamps in real-time, and then review and study the language in the context of those real interactions.

Form: interactive memories collected through smart watch and accessed through phone and desktop

Users: individuals learning their partner's language in a multilingual relationship

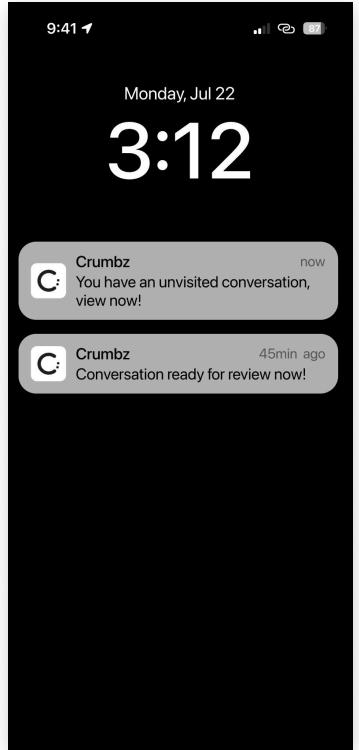
Interactions A.1: conversation capturing and time-stamping

Interactions A.2: (other participants) permitting or opting out of recording

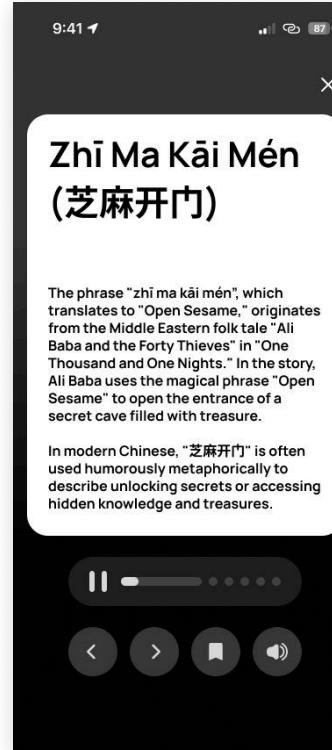
Interactions B: on-the-go study session with quick timestamp viewing and curated memory cards

Interactions C: extended study session on desktop, adding personal edits and studying cultural and language concepts across memories

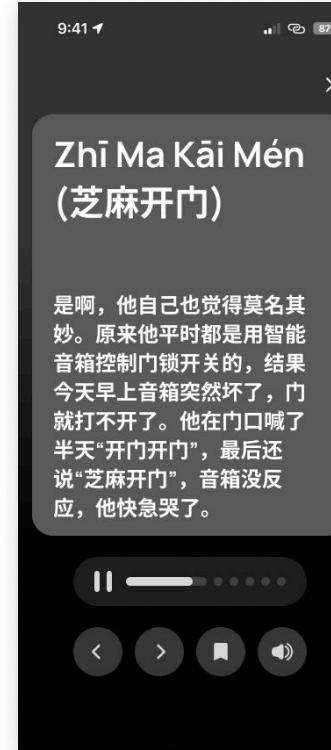
Lo-Fi Prototypes A



0.1 notification



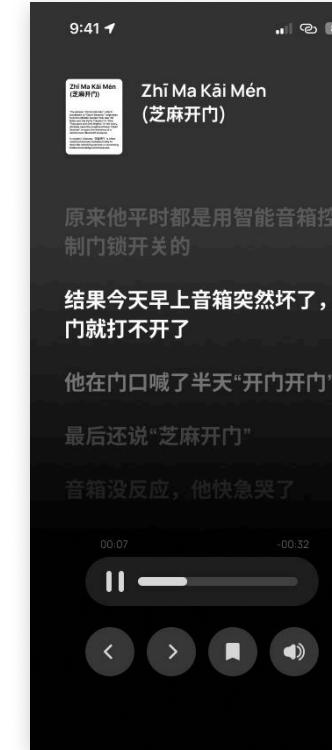
1.1 card front



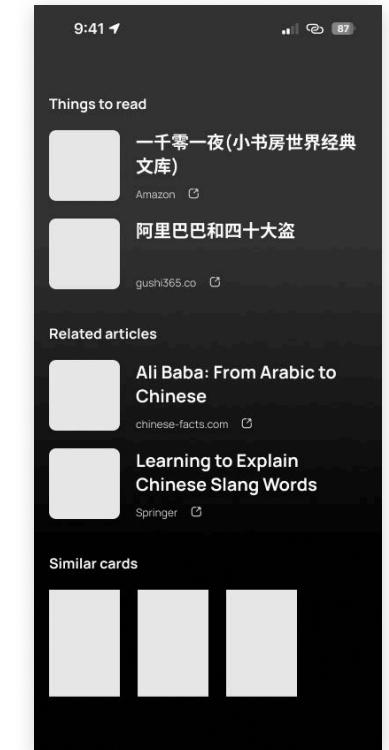
1.2 card back



1.2.1 card hover



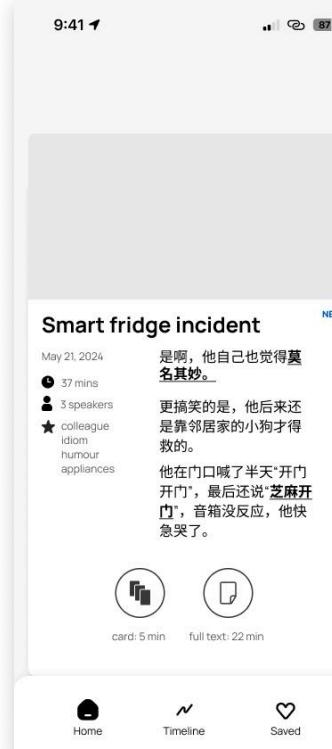
1.3 card transcript



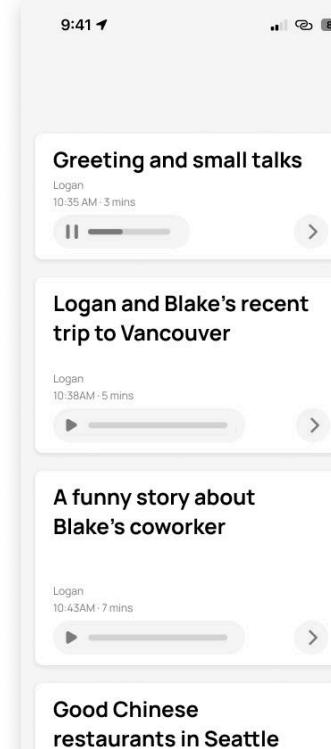
1.4 card context



2.1 home



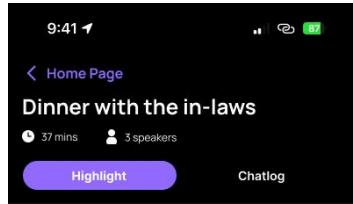
2.2 preview



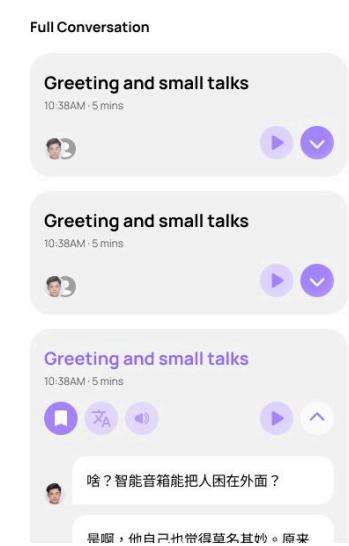
3.1 chatlog topics

13

Lo-Fi Prototypes B



3.2 Conversation A



3.3 Conversation B

4.1 desktop interface



Storyboards

Storyboard



- No touch point involved.

Blake and Logan are in a multilingual relationship. Blake, originally from Shanghai, speaks Chinese, while Logan, from the United States, is learning Chinese to better connect with Blake and her family.

They were having dinner with Blake's dad, who doesn't speak English, so the conversation was in Chinese.



- The Crumbz app on smartwatch detects the target language and prompts recording.
- Crumbz uses Bluetooth Low Energy (BLE) to detect nearby participants and Voice Separation technology to isolate their voices.

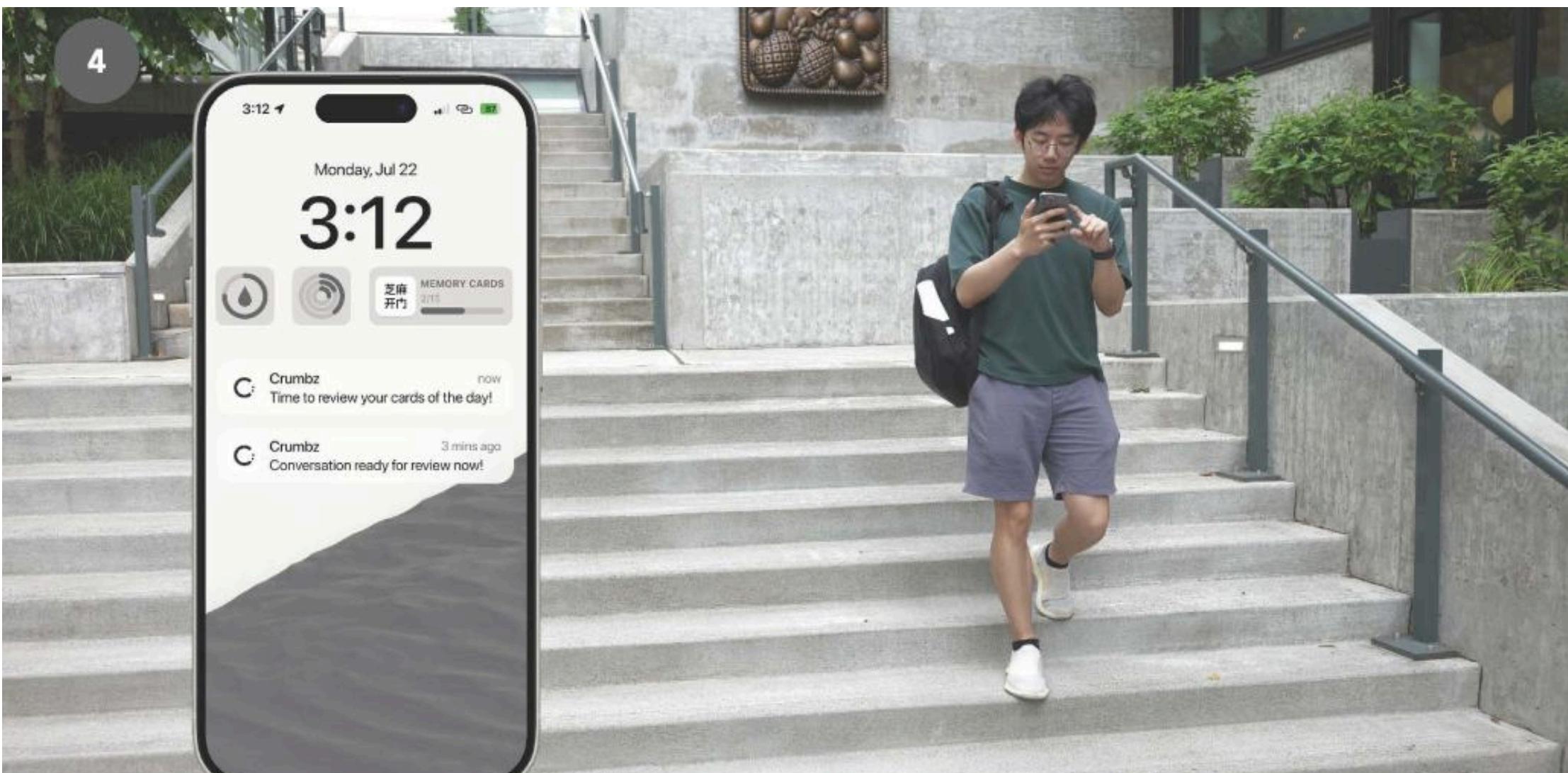
Logan's Apple Watch vibrated with a notification from Crumbz. It detected Chinese and asked if Logan wanted to start recording the conversation. Logan used a hand gesture to start, and the system notified him that one person nearby chose to opt out, so that person's voice wouldn't be recorded.

Storyboard



- The system allows users to create timestamps during a conversation by double-tapping on smartwatch.

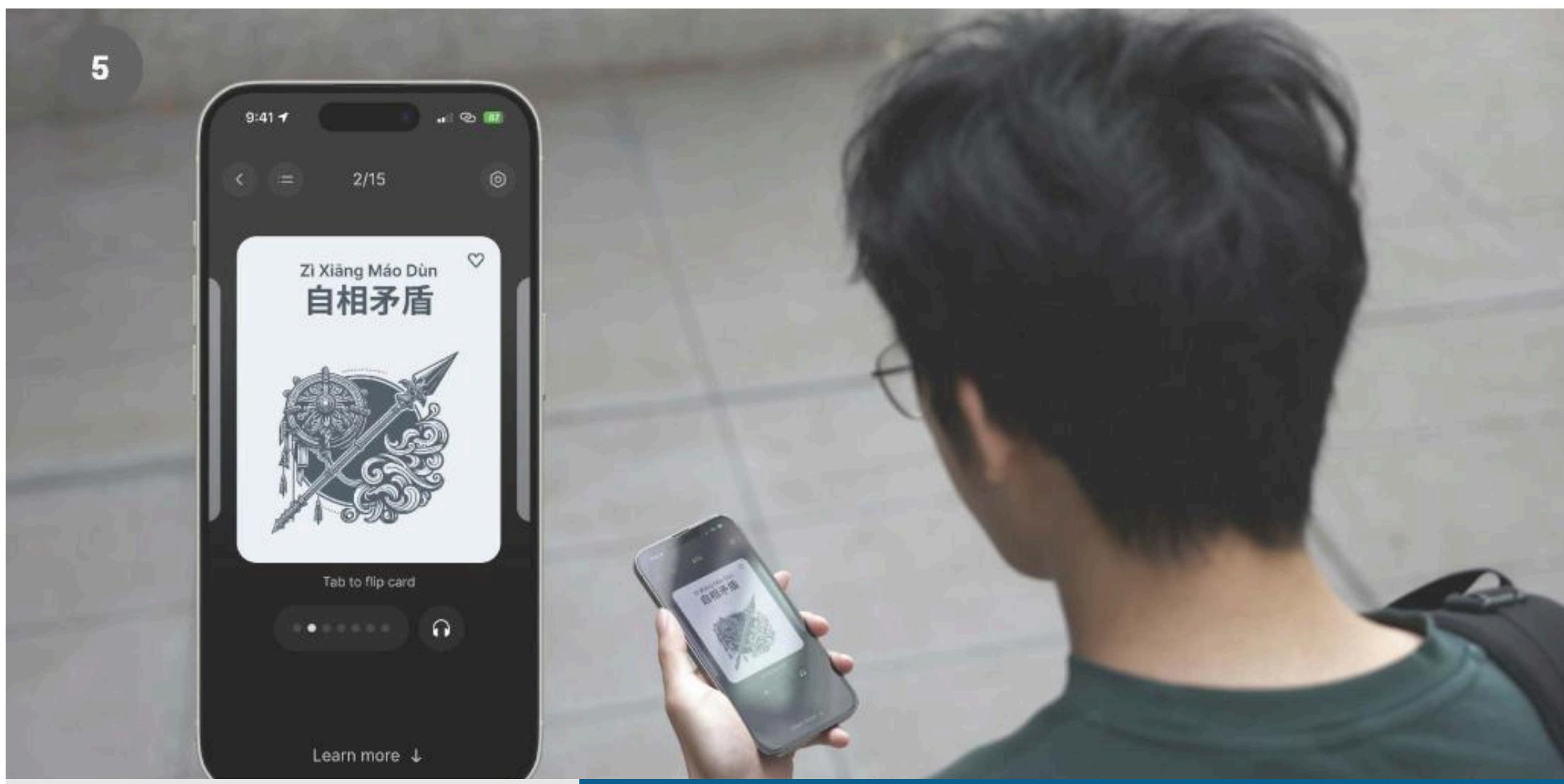
The conversation continued. Logan was able to understand some of it, but there were many stories and jokes he couldn't fully grasp. There was also a word, "矛盾 máo dùn," that kept coming up. Logan didn't understand the word, so he double-tapped his finger to create a timestamp.



- The system processes recorded conversations and automatically generates personalized learning cards
- Crumbz notifies users when the content is ready through the app.

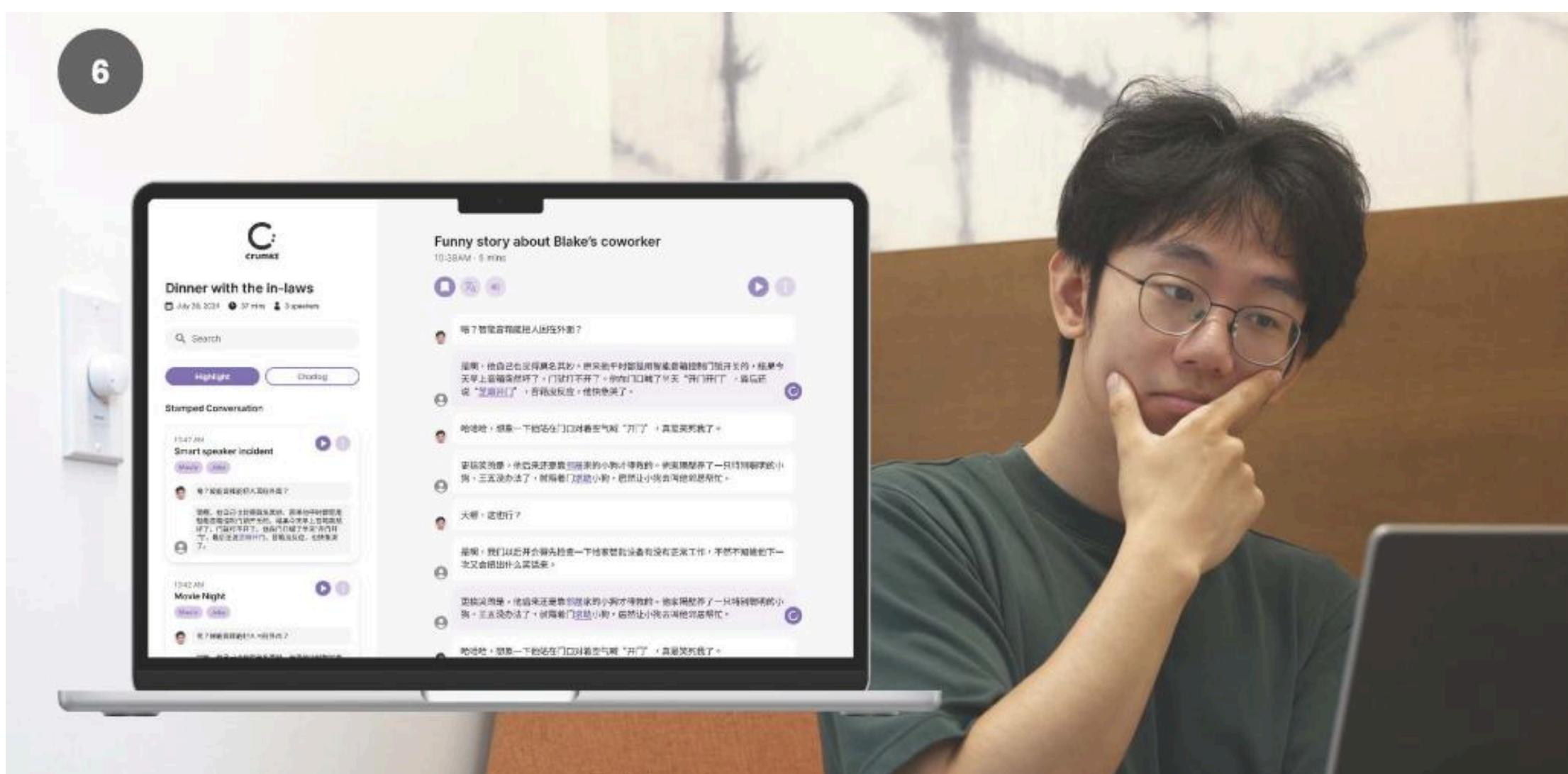
After saying goodbye to Blake and her dad, Logan headed home. On the way, he couldn't wait to "decode" the conversation. Crumbz sent him a notification that the conversation had been processed and new learning cards, tailored to his fluency, preferences, and timestamps, were ready. He opened the app and chose the latest conversation to review.

Storyboard



- The system presents vocabulary cards that, when clicked, flip to reveal detailed explanations.

Logan saw the vocabulary he was confused about earlier. He clicked on the card to flip it and finally understood. It was a concept unique to Chinese culture that couldn't be translated directly, so additional context was provided to help him understand.



- Crumbz allows users to review full conversation transcripts on their laptop device, complete with synchronized audio, translations, and neatly organized timestamps.

When Logan got home, he wanted to review the conversation and understand the parts he didn't get. He opened Crumbz on his laptop, accessed the conversation, and chose to review the full text with audio and translation. All of the timestamps Logan made during the conversation were neatly organized with topics and actual dialogue. He browsed through all the timestamped sections.

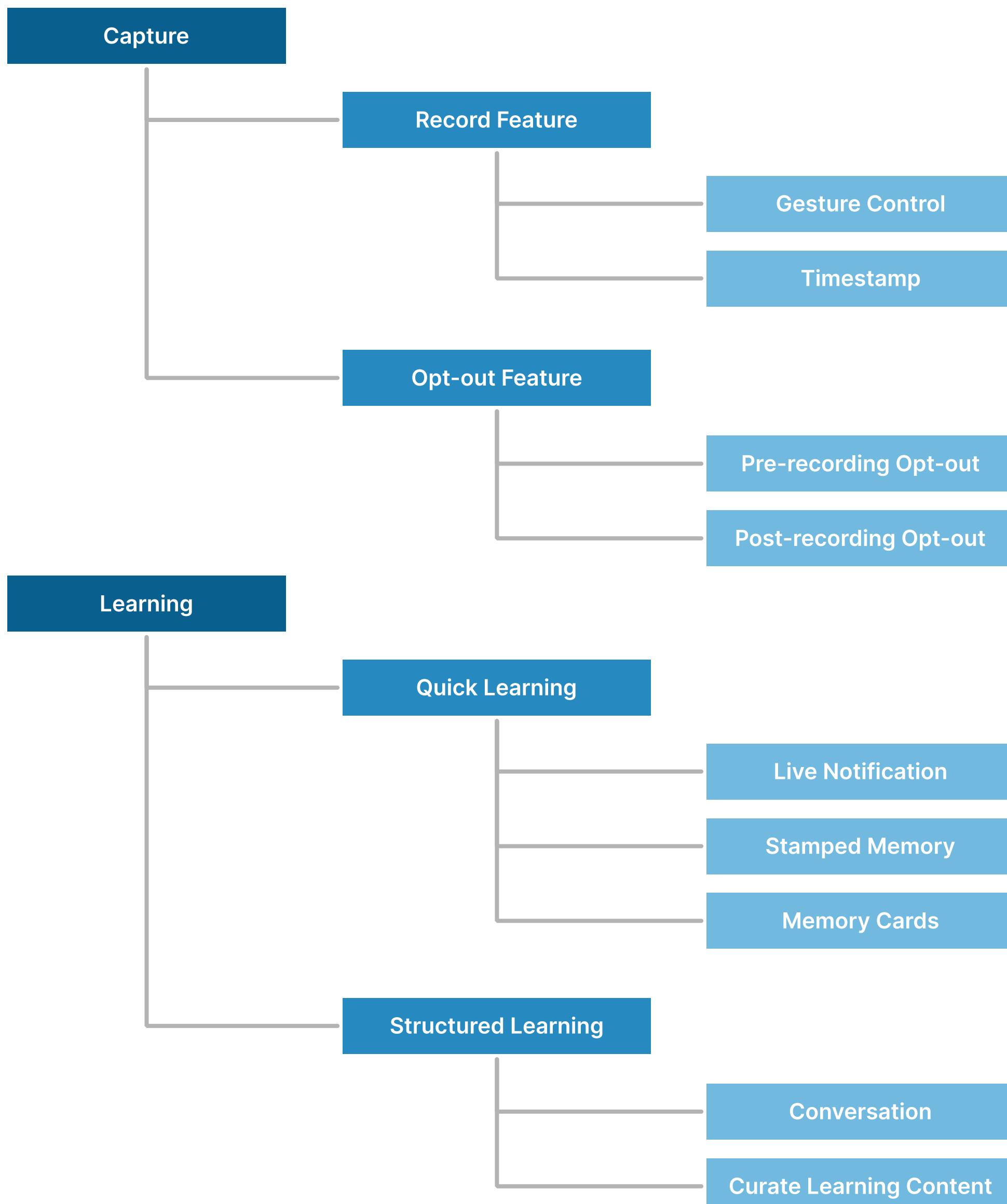


Information Architecture and System Models

01. Information Architecture
02. User Flow
03. Technology Stack

Information Architecture

The Crumbz experience is composed of two parts: capturing the memory and learning. The capturing blends organically with the user's everyday conversation. When the conversation is over, users can then choose to access the learning material at the time of their choosing. Crumbz does not stand between the users and their partners in the moment, but captures those moments for learning at a later time.



User Flow: Conversation Capture

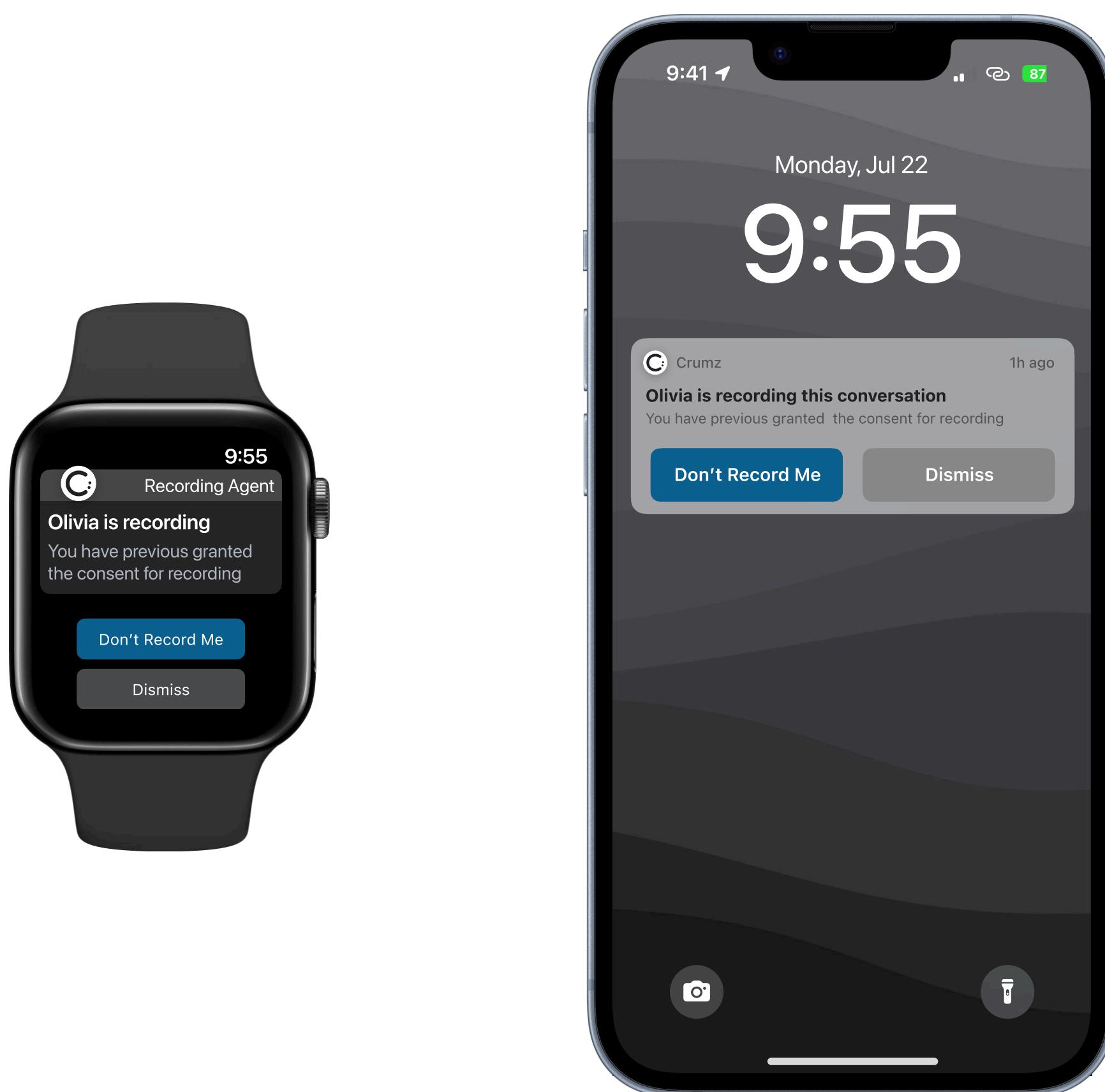
Smartwatches are the main touch point of the conversation capture experience to facilitate the least amount of intrusion into the moment. When the target language is detected, Crumbz will send a notification to the user, and they can start the recording right away by tapping their fingers. Users can also manually start the recording from a smartwatch shortcut.

When there are parts of the conversation that users don't understand, or if they want to visit a certain part later. They can create a timestamp by either tapping their fingers or pressing the button on the watch.



User Flow: Recording Opt-out

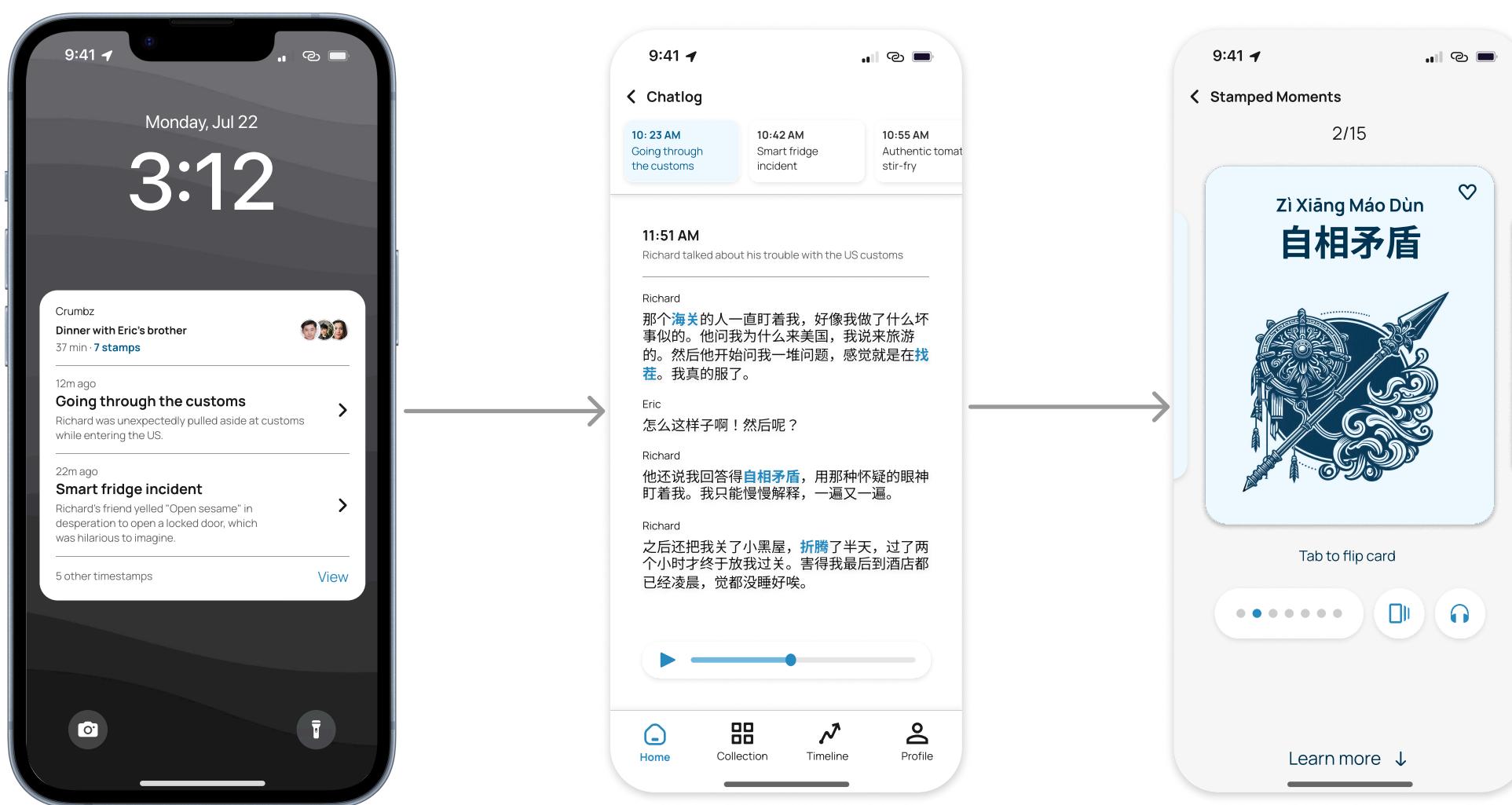
A highlight of Crumbz is our privacy protection feature that allows everyone around the users to opt out of the recording. When a user starts recording, everyone around them will receive a notification. Only after they gave consent to the service will their voice be recorded. People who previously granted consent to be recorded, like the user's family and friends, will not have to give the consent again but they still have the option to opt-out from the recording, even after the conversation.



This feature takes advantage of Bluetooth Low Energy(BLE) technology to detect who is around, and Voice Separation technology by Meta AI to separate certain speakers' voices. In the future, we imagine a protocol that's installed in everyone's phone, so people can give consent and opt-out from recording even if they don't have Crumbz on their phone.

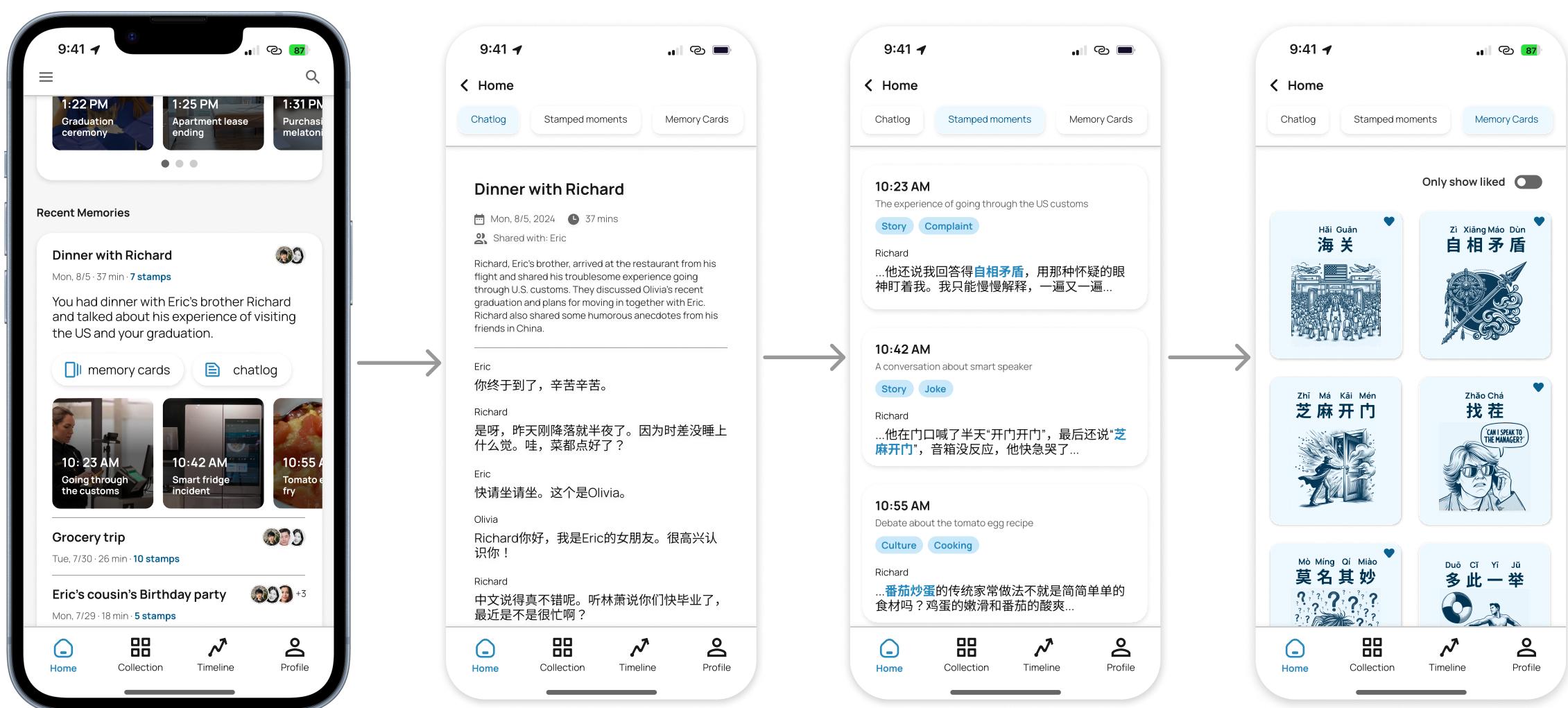
User Flow: Quick Access

A highlight of Crumbz is our privacy protection feature that allows everyone around the users to opt out of the recording. When a user starts recording, everyone around them will receive a notification. Only after they gave consent to the service will their voice be recorded. People who previously granted consent to be recorded, like the user's family and friends, will not have to give the consent again but they still have the option to opt-out from the recording, even after the conversation.



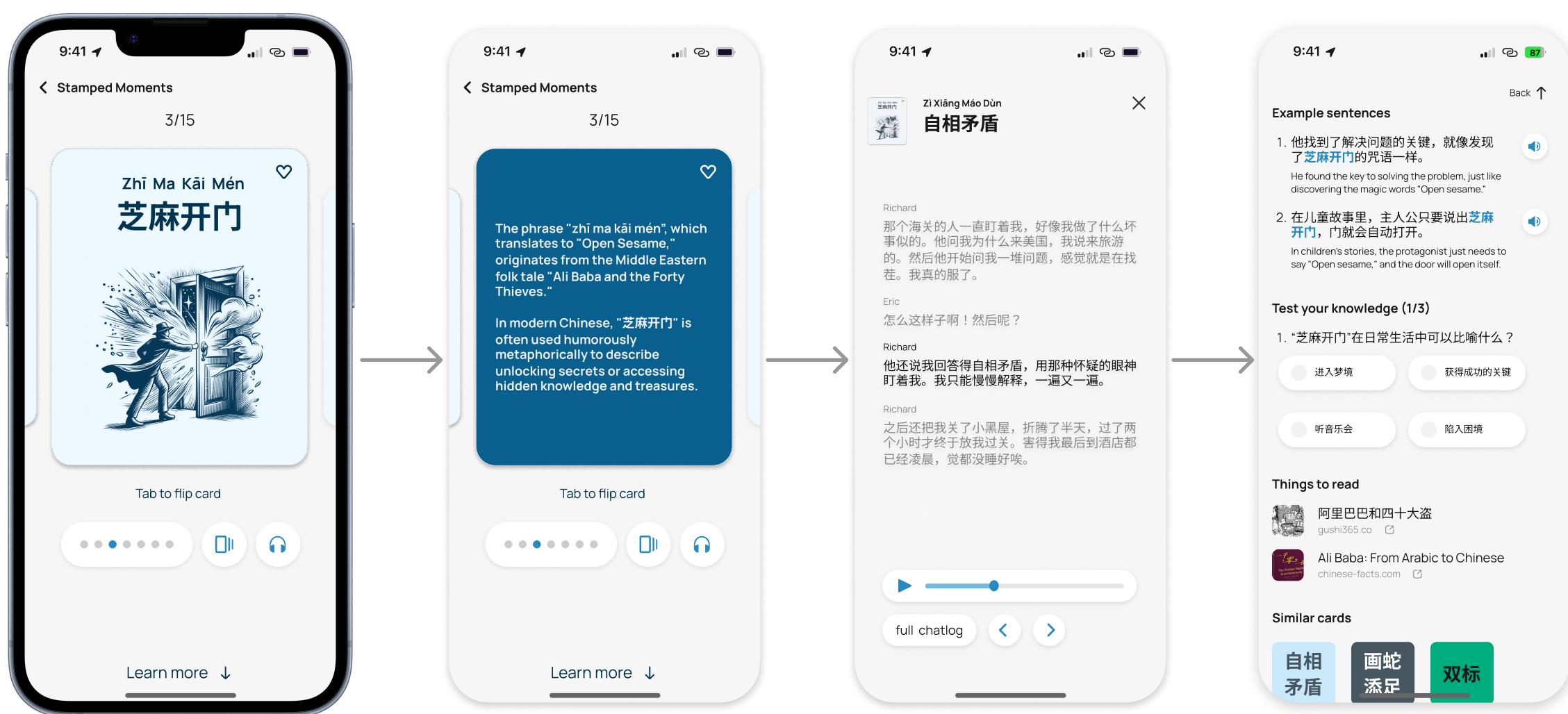
User Flow: Captured Memories(Mobile)

A highlight of Crumbz is our privacy protection feature that allows everyone around the users to opt out of the recording. When a user starts recording, everyone around them will receive a notification. Only after they gave consent to the service will their voice be recorded. People who previously granted consent to be recorded, like the user's family and friends, will not have to give the consent again but they still have the option to opt-out from the recording, even after the conversation.



User Flow: Memory Cards

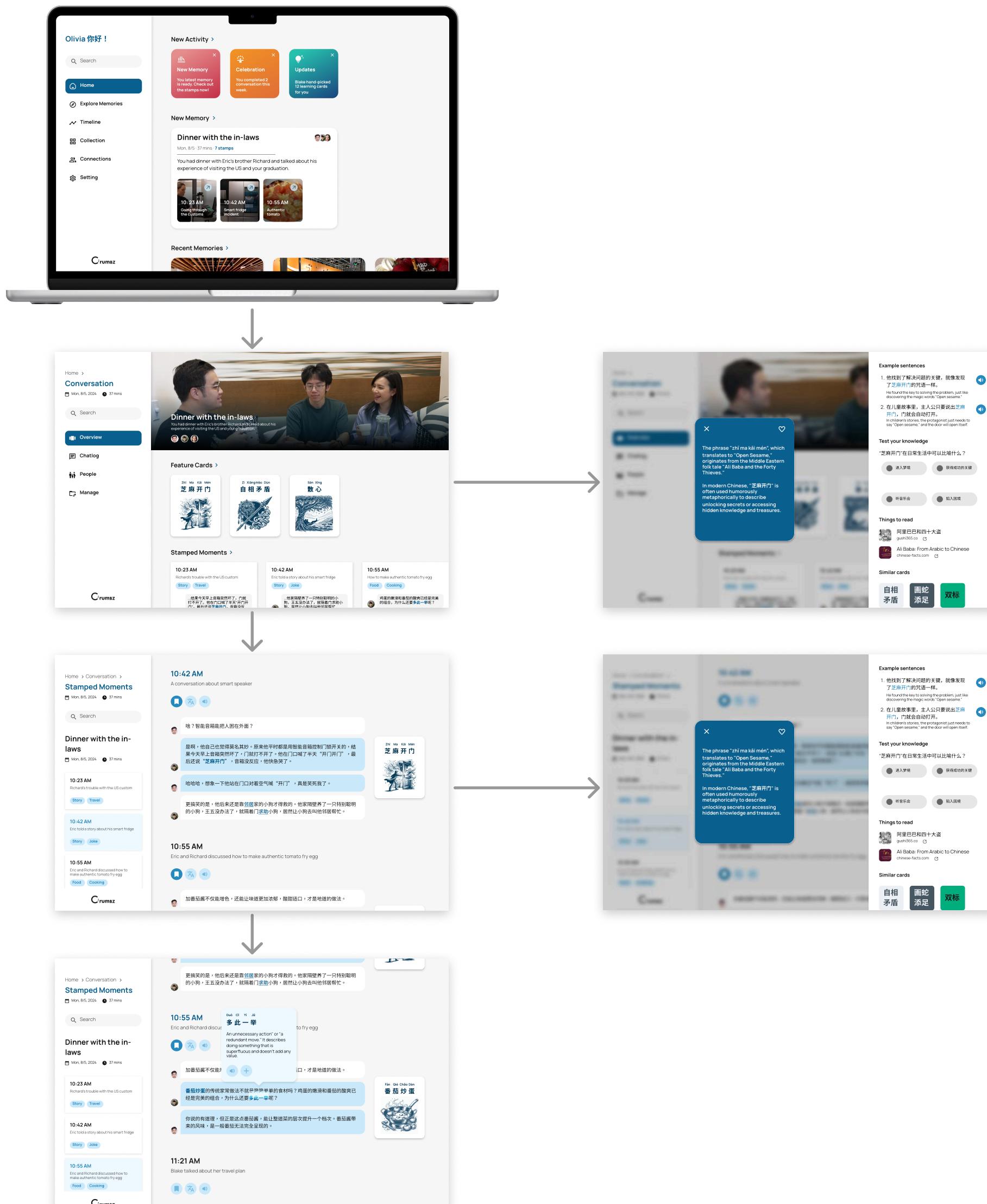
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User Flow: Captured Memories(Desktop)

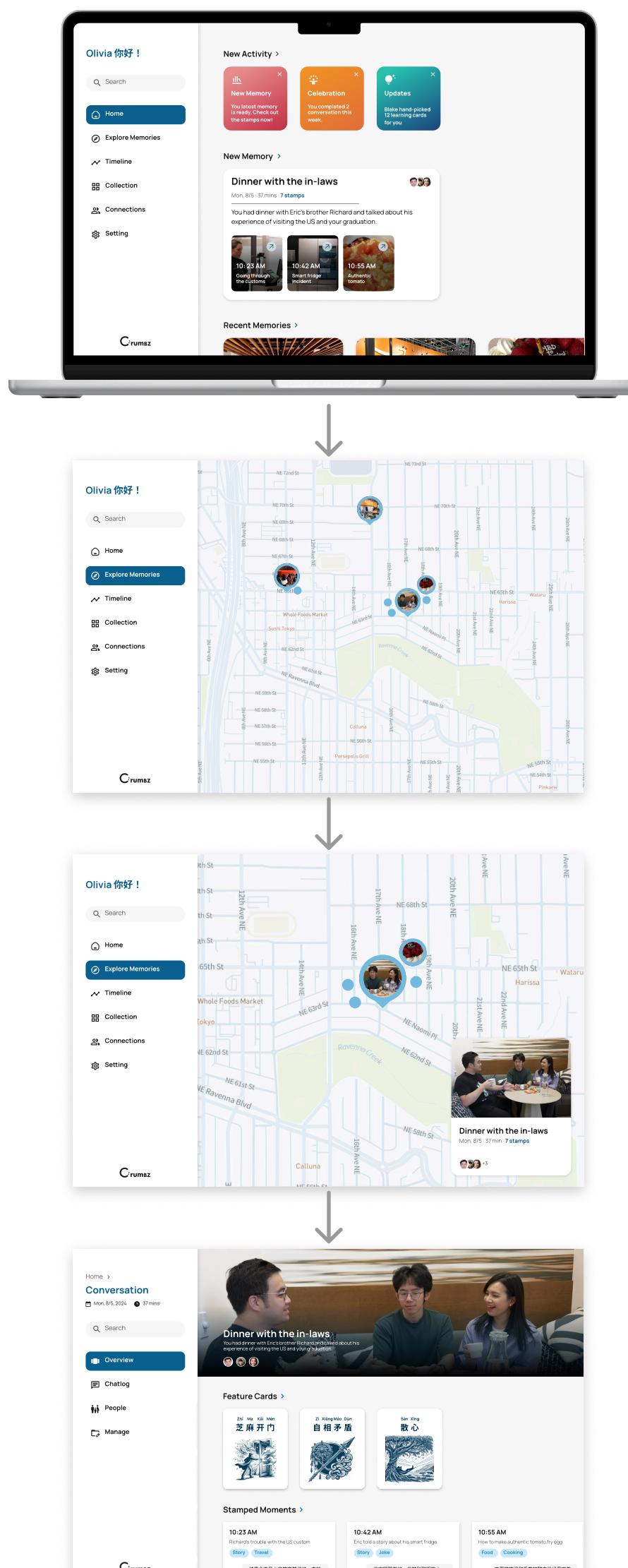
When users access Crumbz on their laptops, they can enjoy the same features on the phone, but with more structure that's helpful for users to understand the whole conversation.

Conversations can be viewed as complete chat logs with timestamps. Users have the option to add any vocabulary or cultural concept from the conversation to their collection of memory cards. They can also invite their partner to curate the learning content for them.



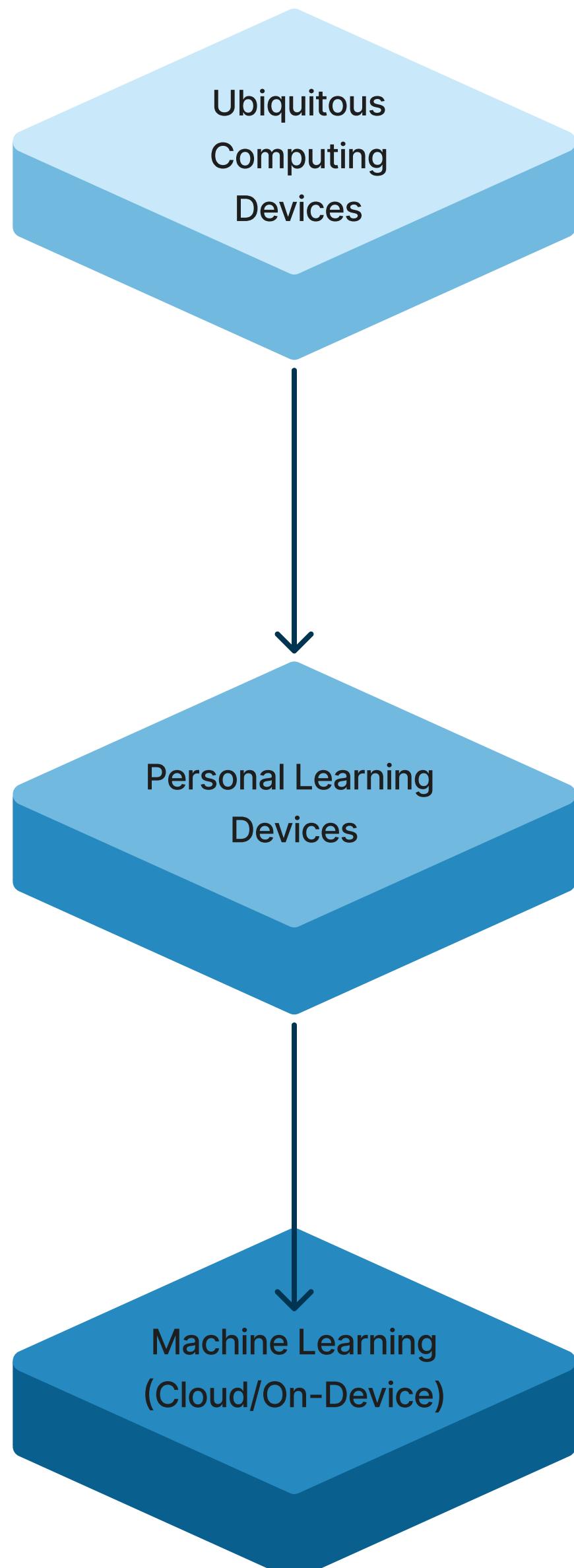
User Flow: Browse by Location

We also include features that allow users to interact with the captured memories in different ways. They can view memories on a map, browse them by location, and see a visualization of where their memories located.



Technology Stack

There are three layers of technology supporting the Crumbz experience. They are ubiquitous computing devices, personal learning devices, and machine learning frameworks. The design presented in this document is an example of a feasible solution.



Memory capturing is supported by ubiquitous computing devices like smartwatches, AR glasses, AI Pin, or other devices that the user carries around with them every day. Different devices are optimal for different types of capturing. For example, watches can be controlled with gestures, and AR glasses can capture images besides audio.

With communication technology that requires low energy consumption like Bluetooth Low Energy(BLE), these devices can communicate with each other regarding users' privacy preferences.

Users access the captured memory on their personal devices. Different devices afford different learning experiences. We envision an adaptive UI design suitable for different mediums, modalities of interaction, and screen sizes. The captured memories can be learned through visual, audio, or even AR in the future.

A key technology that transforms captured data into learning material is the Large Language Model(LLM), with rising computing power on personal devices, we can see these types of data processing happen on personal devices to protect users' privacy, with more complex AI interaction(i.g. image generation) happens on the cloud.



Visual System

Typography & Colors

Display

The largest text on screen reserved for short, important information.

40pt
Manrope

Display 01
Regular

Display 02
SemiBold

Heading

Dictates hierarchy by breaking up content into sections.

24pt
Manrope

Heading 01
Regular

Heading 02
SemiBold

Heading small

Sub-header for giving context to heading or body.

20pt
Manrope

Label 01
Regular

Label 02
SemiBold

Label 03
ExtraBold

Body

Longer blocks of text for best readability.

16pt
Manrope

Body 01
Regular

Body 02
SemiBold

Body 03
ExtraBold

Body small

Context or secondary body text.

40pt
Manrope

Caption 01
Regular

Caption 02
SemiBold

Caption 03
ExtraBold

Caption

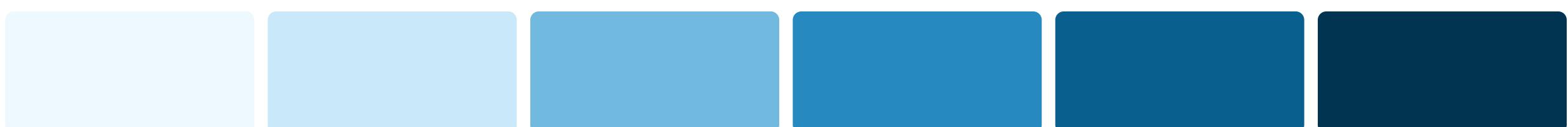
Caption 01
Regular

Caption 02
SemiBold

Caption 03
ExtraBold

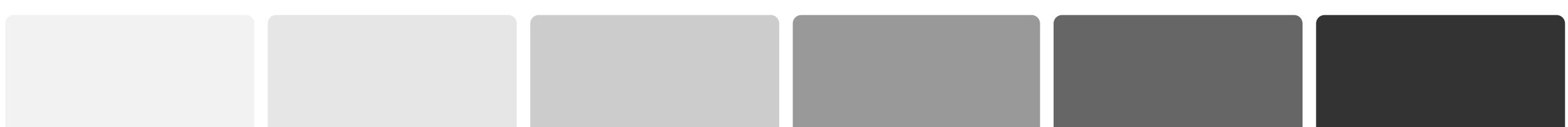
40pt
Manrope

Brand



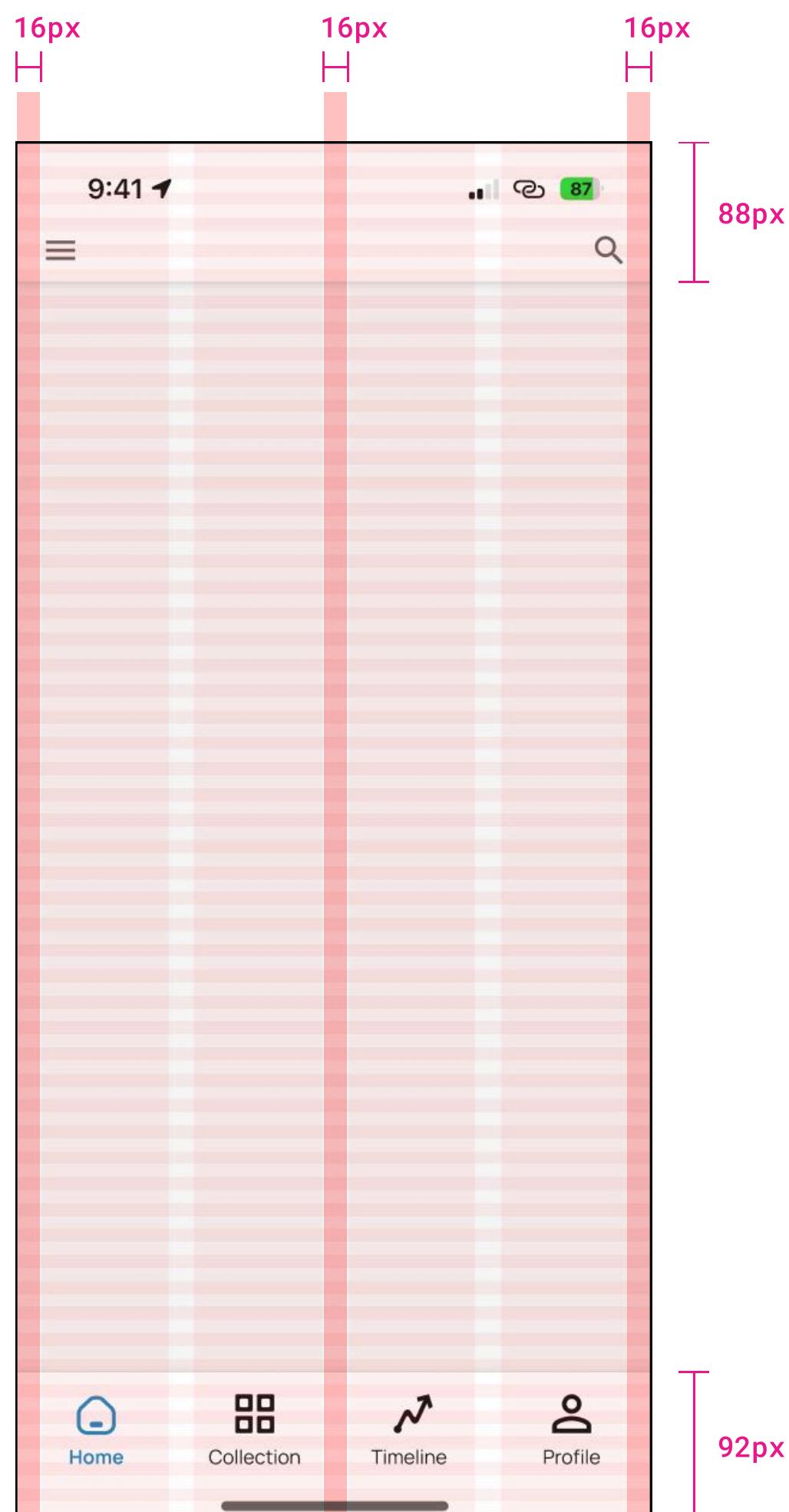
HEX: #EDF8FF HEX: #C9E8F9 HEX: #72B9E0 HEX: #2689C0 HEX: #095F8E HEX: #003451
RGB: 237, 248, 255 RGB: 201, 232, 249 RGB: 114, 185, 224 RGB: 38, 137, 192 RGB: 9, 95, 142 RGB: 0, 52, 81
VAR: \$primary-100 VAR: \$primary-200 VAR: \$primary-300 VAR: \$primary-400 VAR: \$primary-500 VAR: \$primary-600

Neutral



HEX: #F2F2F2 HEX: #E6E6E6 HEX: #CCCCCC HEX: #999999 HEX: #666666 HEX: #333333
RGB: 242, 242, 242 RGB: 230, 230, 230 RGB: 204, 204, 204 RGB: 153, 153, 153 RGB: 102, 102, 102 RGB: 51, 51, 51
VAR: \$neutral-000 VAR: \$neutral-100 VAR: \$neutral-200 VAR: \$neutral-300 VAR: \$neutral-400 VAR: \$neutral-500

Grids



Margin & gutter: 16px
Vertical grid height: 8px

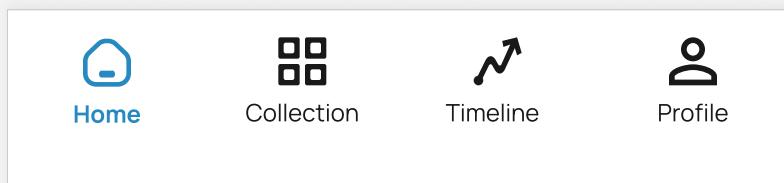
Mobile Interface

top bar

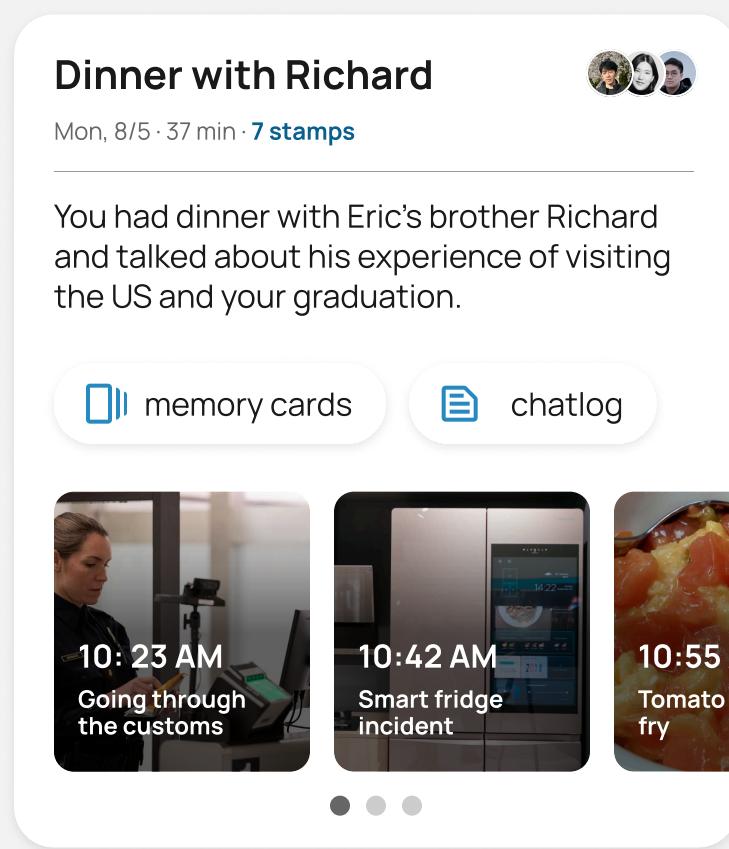


time stamp

tab bar

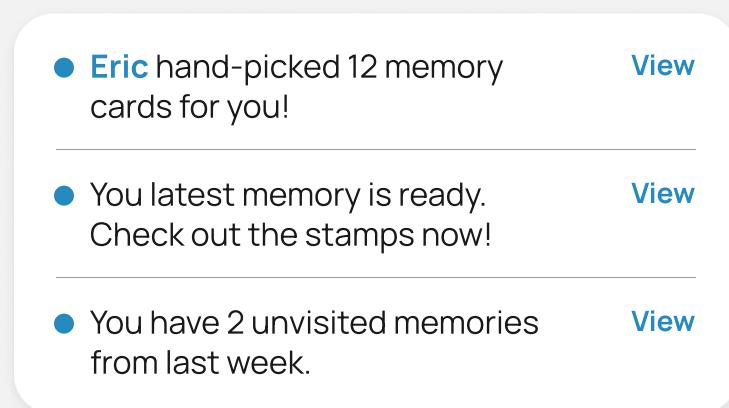


CTA card



chips

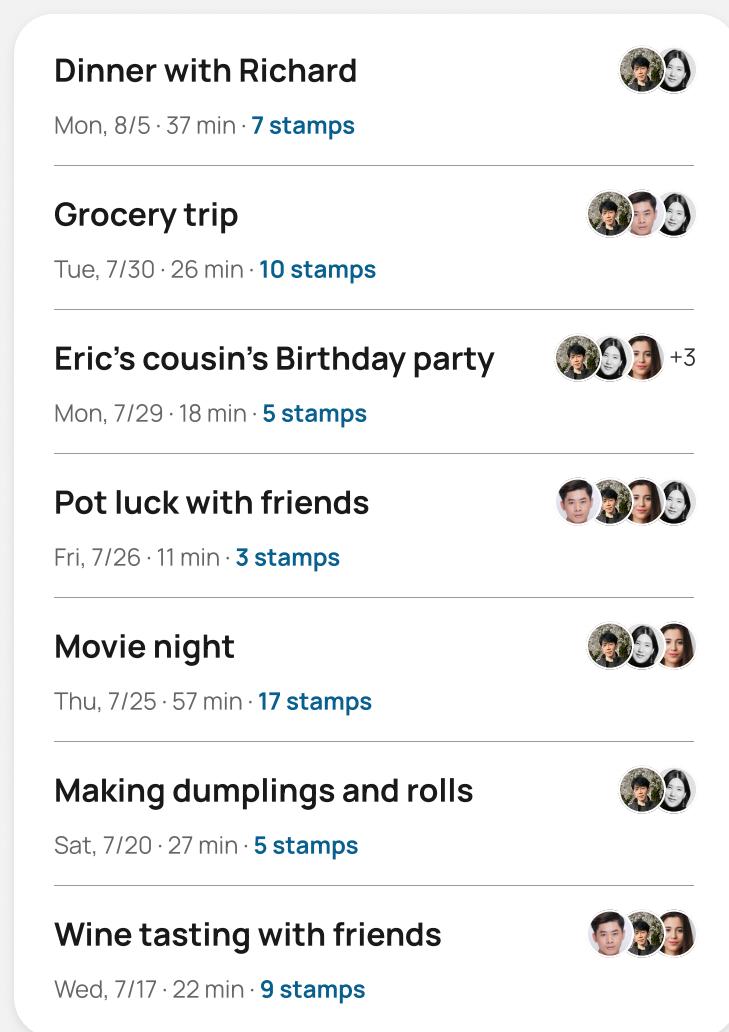
notifications



carousel & audio bar

memory card

memory list



10:23 AM

The experience of going through the US customs

Story **Complaint**

Richard

...他还说我回答得**自相矛盾**，用那种怀疑的眼神盯着我。我只能慢慢解释，一遍又一遍...

Chatlog

Stamped moments

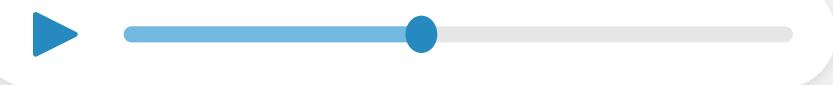
Memory Cards

10:23 AM

Going through
the customs

10:42 AM

Smart fridge
incident



full chatlog



Zì Xiāng Máo Dùn

自相矛盾



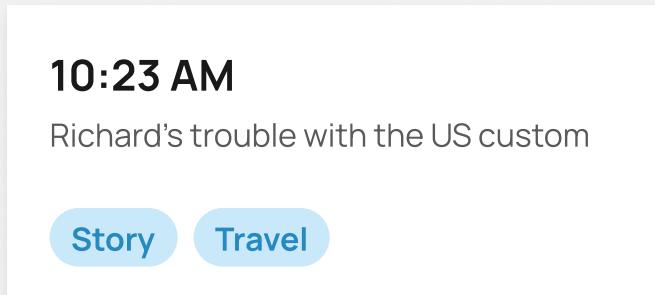
The phrase "zhī ma kāi mén", which translates to "Open Sesame," originates from the Middle Eastern folk tale "Ali Baba and the Forty Thieves."

In modern Chinese, "芝麻开门" is often used humorously metaphorically to describe unlocking secrets or accessing hidden knowledge and treasures.



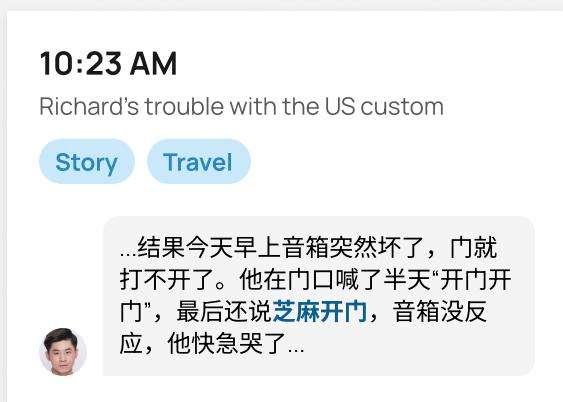
Desktop Interface

time stamp simplified



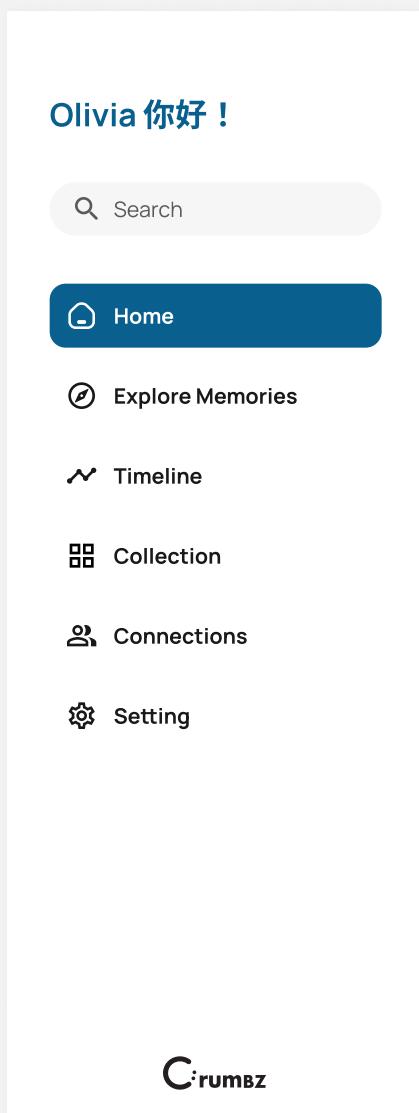
CTA card

time stamp detailed

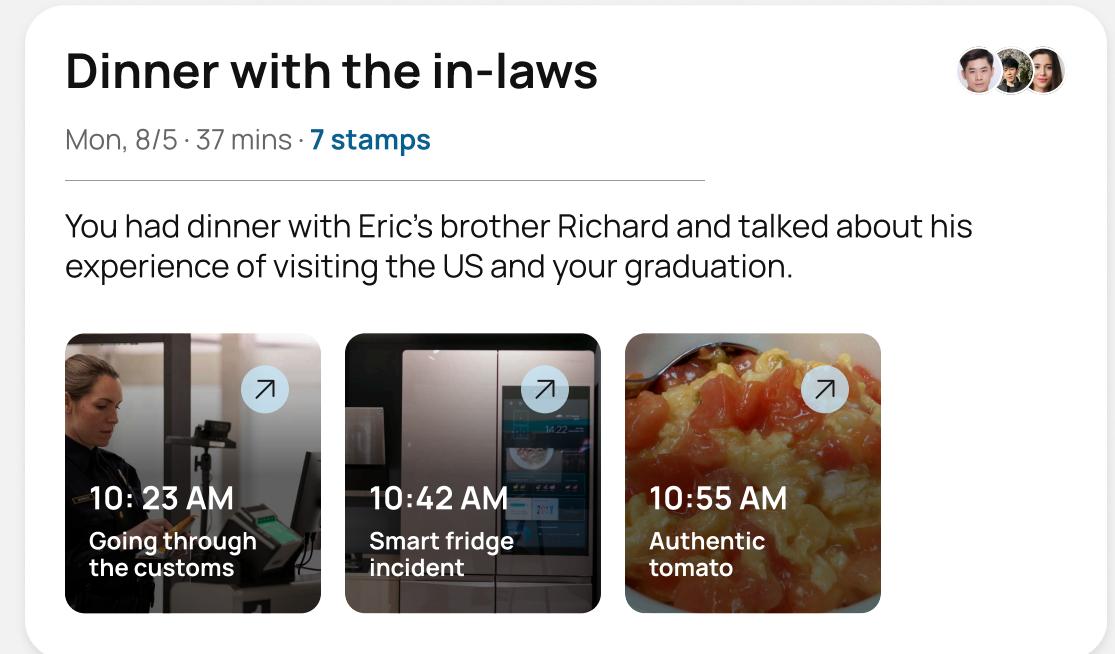


memory card

side menu



look-up dialogue



Dinner with the in-laws

Mon, 8/5 · 37 min · 7 stamps

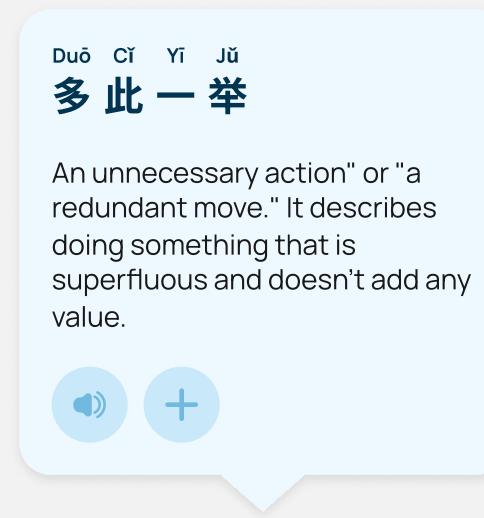
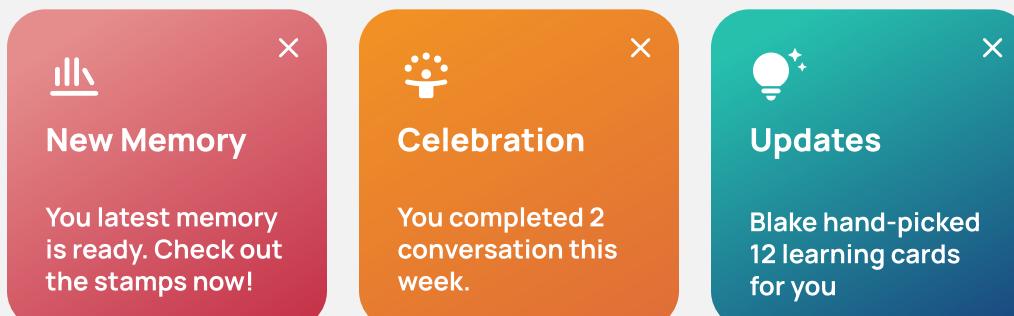


+3

chatlog action list



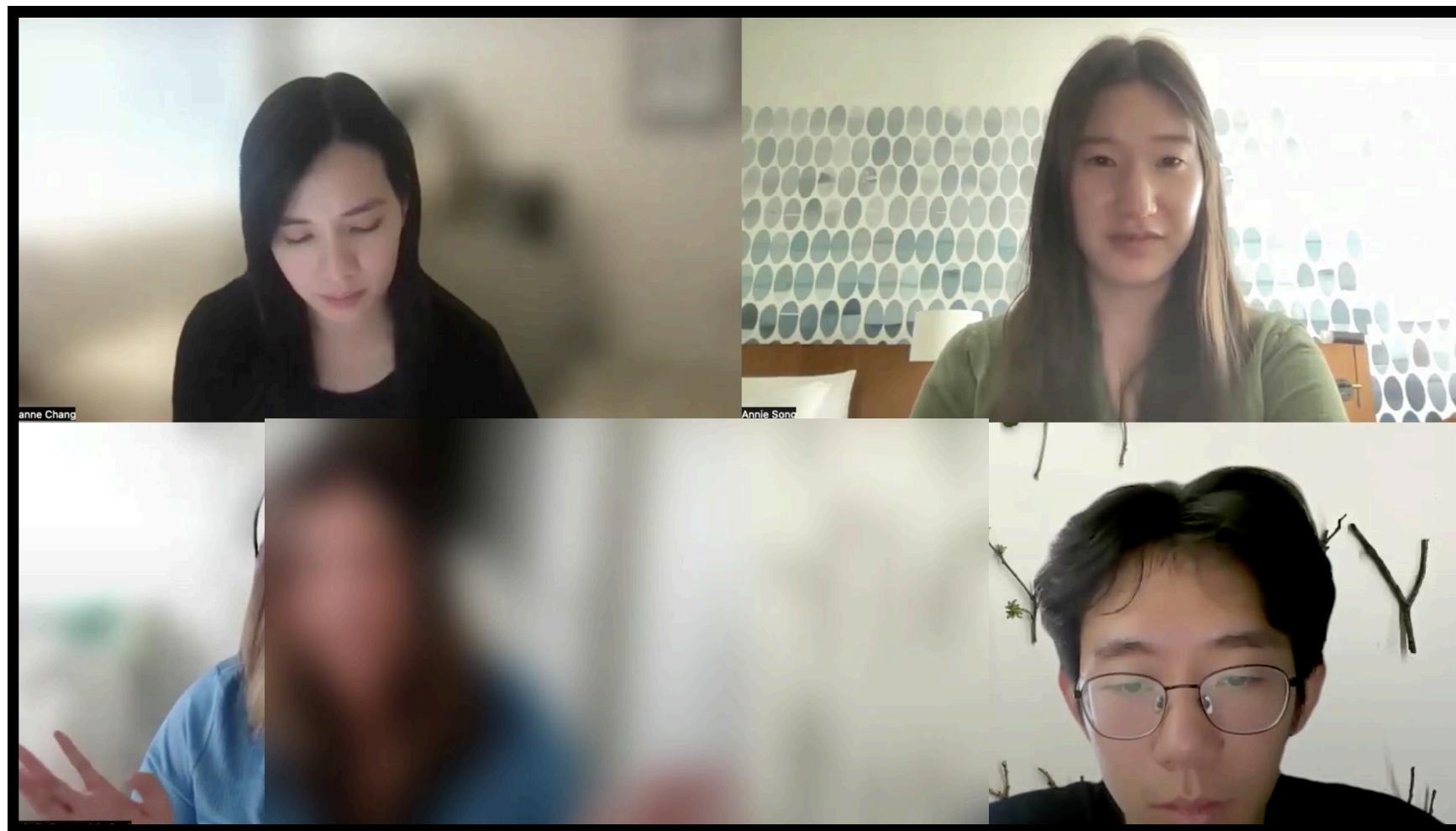
new activities



Evaluation

01. Study Overview
02. Study Design
03. Findings
04. Impact

Study Overview



Concept Evaluation Testing

Before finalizing the design, we conducted concept evaluation testing using a low-fidelity prototype. We chose this method for two main reasons. First, it allowed us to gauge how participants felt about our ideas for the product before the design was locked and finalized. Second, it offered flexibility, as we could evaluate the concepts behind Crumbz without needing to build a polished prototype.

Study Design

Methodology

- 1-hour Concept Evaluation testing over Zoom
- 4 participants + 1 pilot testing
- Individuals currently in a multilingual, romantic relationship who are currently learning or have previously learned their partner's language

Research Goals

- Examine Crumbz concepts
- Identify top barriers and pain points

Study Flow

- **Part 1:** Design Feedback
 - Review storyboard & user flow
 - Review Structured Learning feature, Learning Card feature
- **Part 2:** Value Proposition/Business Impact Feedback
 - Review Product Market Fit
 - Questions around privacy, deepening relationship connection

Main Interview Questions

- **Part 1:** Design Feedback
 - What is your initial impression about Crumbz? Did anything stand out?
 - What are your thoughts on having these different categories generated by the system?
 - I'm curious after seeing the card feature in detail, was there anything you were expecting to see but didn't?
 - Which option do you prefer between Design A and Design B? Why?
 - Other than a vocabulary that you are not familiar with, what other additional topics would you like to see in this card?
- **Part 2:** Value Proposition/Business Impact Feedback
 - What are their thoughts on privacy?
 - How would you rate Crumbz compared to other language learning apps out in the market?
 - Can you tell me after using Crumbz today, do you believe you would revisit the recorded conversation? If so, how often? Why or why not?
 - What are some ways in which Crumbz could improve?
 - What features were you expecting to see as part of Crumbz/language learning tool but didn't see?
 - How do you potentially imagine using Crumbz with your partner in the learning experience?

Findings

What Worked

■ Personalized content from real-life examples

“The premise is very simple, but in my opinion, very effective and very based on how I learn in real life...And it's like almost creating a personalized lesson for myself” - P4

“I like the idea of using real life examples” - P2

■ System-generated naming & categorizations

“I like the auto-generated categories because anything that lowers the effort makes me feel like I would use it more” -P3

“Categorizations is good because that's probably better than me naming them” - P1

Room for Improvement

■ Lack of user agency to edit and customize content

“Having some editing abilities can be really nice...It could also just be a little nuances of the family like ‘we always say this particular phrase’ ‘this is kind of like an inside joke’”-P2

“Feel like you should also be able to tell the app which cards you already know, so they don't keep on coming up” -P3

■ Disconnection between two main features

“One thing I would expect is a place where I can see all the cards from all conversations. So I could go to a place where I just want to see nothing but cards, a collection from all the conversations that I've had and recorded” -P4

Validating Market Fit

Concept testing helped us determine whether there was genuine demand for Crumbz before we invested significant time and resources into the final design. By engaging with participants during concept testing, we were able to narrow down our target audience to language learners who are beginners but have some exposure to the target language and want to take the next step with real-life examples. Moreover, through concept testing, we discovered that Crumbz differentiates itself from existing language learning products by being closely aligned with how things work in real life and how learners naturally acquire language skills.

Identifying and Refining Core Features

User feedback from concept testing revealed which features are most valuable to our potential users. This insight allowed us to prioritize essential features and refine or eliminate less important ones, resulting in a final product that is better aligned with user needs and expectations. Specifically, we learned about users' preferences for the type of content they wanted to see in the Memory Cards feature and how they preferred captured conversations to be displayed in the Captured Memories feature.



Equity Analysis

Equity Analysis



At Crumbz, we embrace true diversity and inclusion.

Crumbz is a product designed to help language learners in multilingual relationships effortlessly capture, review, and learn their partner's native language through conversations and cultural experiences. As language as our fundamental building block, we welcome and celebrate people from every country in the world to use Crumbz.

To develop a product that meets the diverse needs of our learners, the teams within Crumbz must first embody the principles of diversity, equity, and inclusion. We will keep these principles in mind when practicing product inclusion and equity.

- 1. Cultural Respect and Awareness:** We prioritize understanding and respecting the cultural nuances of our users. By incorporating cultural contexts into our product, we ensure that learning is both meaningful and authentic.
- 2. Inclusive Design:** We commit to designing Crumbz with all users in mind, ensuring accessibility and usability regardless of language proficiency, cultural background, or technological literacy.
- 3. Continuous Learning and Adaptation:** We recognize that diversity is dynamic. Our team is committed to continuous learning and adaptation, actively seeking feedback to improve the product and better serve our global community.



Environmental Impact

Environmental Impact



Our approach to sustainability in product design and development is centered on two key principles: sustainable use and continuous improvement.

1. Sustainable Use

Our approach to sustainability in the design and development of Crumbz is grounded in the understanding that language learners thrive in immersive environments, which their partners are uniquely equipped to create. Crumbz leverages these organic moments, transforming them into personalized language learning experiences while ensuring that every aspect of the product aligns with our sustainability values.

2. Continuous Improvement

Crumbz is not only an interactive memory log designed to help language learners in multilingual relationships seamlessly capture, review, and learn from their partners' conversations and cultural exchanges. It is also a product deeply committed to sustainable use and continuous improvement. By focusing on extending the product's lifecycle, and engaging users in sustainable practices, Crumbz aims to provide a meaningful learning tool that supports both language growth and environmental responsibility. Through regular sustainability audits and user feedback, Crumbz evolves to meet the highest standards of sustainable design, ensuring it remains a responsible and innovative tool for language learning.



Team Reflection

Team Reflection



Peter Lin

“Our product as a secondary learning resource”

This product is designed to work alongside traditional learning resources like textbooks, language classes, and apps. While those tools provide a systematic approach to grammar, vocabulary, and language rules, our product offers real-world application and cultural context that those resources often lack, bridging the gap between theory and practice. BUT we should acknowledge this product not a standalone solution for language learning, so we should consider how it fits into the broader journey of learning.

“Jack of all trades, master of none”

The product’s broad focus on multiple features—recording conversations, teaching language, exploring culture, and providing context—may lead to a situation where it does many things adequately but fails to excel in any single area. This could result in a less cohesive user experience where no one feature stands out as exceptional. In trying to be everything at once, the product might dilute its core purpose. The original intent—to support language learners in real conversations with their partner’s family and friends—could get lost in the effort to also be a cultural guide, a memory log, and a language tutor all at once.

Team Reflection



Alex Chen

“Non-obvious touch points”

When ideate and iterate toward the final design, explore the affordance of each possible devices and touch points in the process. The core value proposition of our product remains similar across the ideation process, but different medium and touch points brought different form of the interaction, hence different experience. Exploring different touch points gave us the chance to think about what are some of the more interesting way we can convey our value to the users.

Team Reflection



Annie Song

“Disagree but commit to it”

It's okay to have disagreements within the team, but what's really important is having the mindset to commit to the project, whether you agree or disagree with it. Our team was able to move forward not because we were perfectly aligned on ideas but rather, we all had the commitment to be present, work hard, and completely commit to the project.

Team Reflection



Joanne Chang

“Failing Faster and Adapting Quickly”

During the research and ideation phase of Crumbz, I learned the importance of failing fast and adapting quickly. Although we began with a well-defined research plan, as we moved forward, it became clear that pivoting was necessary to stay on track with our timeline. Besides, I appreciated the freedom to share early, unpolished ideas. Even though these concepts were not fully developed, they often sparked valuable discussions and inspired others on the team to think creatively. By fostering an environment where it was safe to fail and iterate quickly, we were able to refine our ideas and ultimately create a more robust solution for Crumbz.