

Japanese Language Learning in VR

A Purdue UX Project for Professor Kazumi Hatasa

Made with love <3

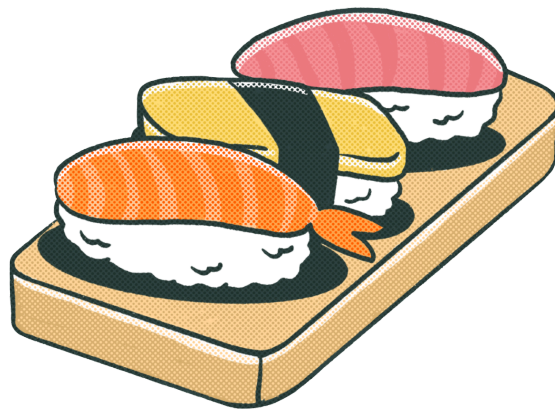
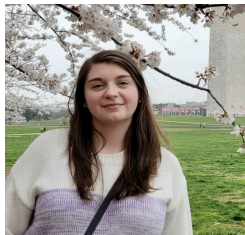


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Meet the Team



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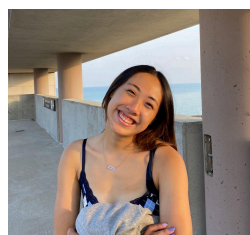
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Project Overview

Project Scope

The overarching goal for this project was to design an immersive and entertaining VR experience that aids students in learning to read, write, and speak Japanese outside of class.

This project's narrowed scope focused on the learning and recognition of characters in the Japanese syllabaries Hiragana and Katakana through a VR game.

Project Goals



Aid students in Japanese language learning through engaging practice outside of class to strengthen skills for in-class engagement.



Familiarize and increase recognition of Japanese characters, specifically their sounds, shape, and stroke order

User Group and Behaviors



Our main user group is **students learning Japanese as a second language**, with a specific focus on beginners. Within the current Japanese language learning curriculum at Purdue, this would be students in JPNS 101: Japanese Level 1 and JPNS 102: Japanese Level 2.

These users are looking for a fun and effective way to practice their Japanese outside of the classroom, as class time is focused on oral skills.

Final Concept

Game Design

Our final game concept puts the player in charge of a sushi restaurant in which they must complete educational tasks as they grow their business. We hope that progressing through the game's story and unlocking new recipes, upgrades, and cosmetics will **motivate students to play for fun** and enjoy the experience. Each minigame was designed with a different educational goal in mind. For example, the garnishing game is designed to familiarize players with the shapes of different characters while the ingredient selection game is designed to teach players the sounds associated with each shape.

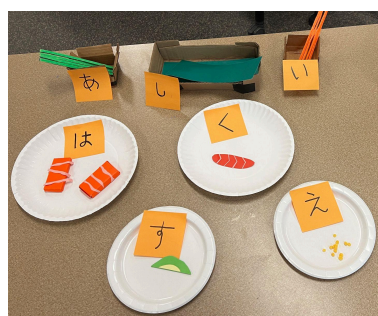
Minigame Concepts

Each minigame is designed to **build familiarity** with Japanese character shapes and sounds in students.

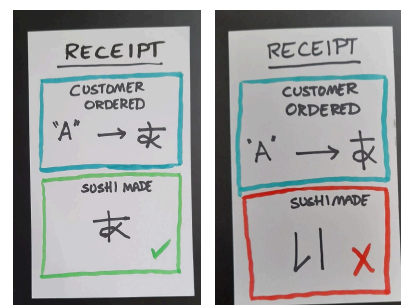
Minigame 1: Matching



NPC ordering sushi



Sushi ingredients labeled with characters

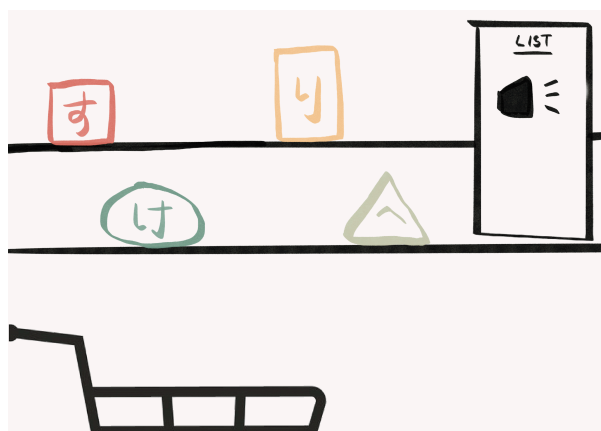


Receipts tell players what they did right and wrong

This minigame consists of sushi roll ingredients that are labeled with Japanese characters. Players make sushi by selecting the ingredients with labels that match the sound the customer made, and this helps **reinforce sound-shape recognition**.

If the player selects the correct ingredient quickly they get a good tip from the customer. If they get it wrong, a sound effect plays upon adding the ingredient to the roll for immediate feedback and the customer will tip less depending on how much the order has been messed up.

Minigame 2: Grocery Shopping

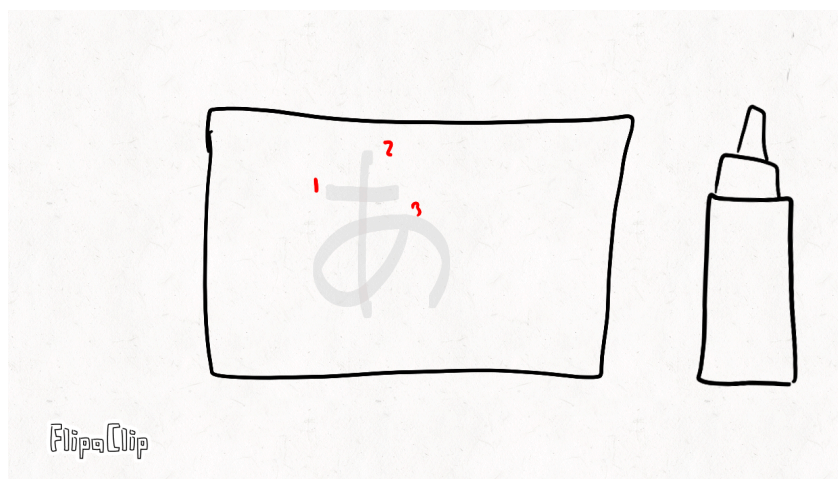


Selecting an ingredient from the shopping list

The second minigame is a grocery shopping game. When a new recipe is unlocked, the player must buy any new ingredients for it. At the store, players hear the sound of a character or word being played from their shopping list. They will then pick up the character-labeled food item from the shelf and put it in their cart.

If the wrong item is added to the cart, a red “x” will appear, providing the player with immediate feedback. Matching the sounds to the characters works to **strengthen the player’s sound/shape recognition** and adds some variety to the game. The shopping environment also provides opportunities to introduce characters/words outside of the restaurant context, **broadening the user’s vocabulary.**

Minigame 3: Garnish Writing



Practicing stroke order through garnishing

Stroke order is an imperative aspect of writing Japanese characters so we designed this minigame to focus on writing and stroke order. Users trace the displayed Japanese character in the correct stroke order to “garnish their sushi” with sauce. The numbers serve as a guide to indicate where to begin writing and in what order.

Japanese writing also involves precise, small details that we weren’t able to design for given the limitations of VR. One element we couldn’t include is something called a release. This is when the writing utensil is gradually lifted from the page while writing to create a line that gradually thins out until it is *released* from the page. This doesn’t translate well to VR as pressure gradients are very difficult to implement. Writing is often a binary writing or not writing system and players can’t feel the presence of in-game objects so there is no haptic feedback for how much pressure they are applying to the page.



Story Mapping

An onboarding player backstory is an essential part of any successful interactive game. We created a story map to brainstorm and organize our ideas for an immersive storyline that would engage our users from the start. We also sought review from our sponsors to ensure that our story was culturally appropriate and sensitive. Below is our finalized storyline for our onboarding story.

Onboarding Story

The game is centered around the player owning and operating a sushi restaurant through various educational minigames. At the start, the player is a regular customer of an old sushi restaurant. The sushi master, the owner of the restaurant, is growing old and needs someone to take over the business. The master offers to take in the player as his protege and begins training the player to take over the restaurant. Through this training, the player is introduced to the tutorial of educational minigames that will be played throughout the game.

After the training is completed, the player is given an optional skills test to determine their strengths and weaknesses. This allows the game to cater to the player's knowledge and focus on what they need to learn the most.

Game Flow

Below is a diagram of the proposed game flow the user would go through from onboarding to everyday play. During the tutorial, the player can choose to take a Japanese knowledge test that will gauge their current understanding of the language. This is beneficial to users who already have a grasp of the basics and want more challenging questions. However, if they are beginners, they can opt out of this quiz and the game will automatically start them out at the basics



Game Upgrades

To keep the game interesting and to reward the users' progress and achievements, we devised ideas for game upgrades. Our main consideration for the upgrades were to allow users to personalize their game experience. Users could keep track of and “purchase” these upgrades on a “Computer” in the game. The computer would serve as the upgrade system and automatically have the player's tip earnings available to use for the upgrades.

Cosmetic upgrades for the restaurant can be purchased with tip money. These include:

- Restaurant appearance:
 - Wallpapers
 - Decor
- Equipment
- Knives
- Cutting boards
- Tableware
- These upgrades can be purchased from an in-game “computer” - a mockup of this screen is available in the [images section](#) of the [Appendix](#)

Gameplay upgrades can be unlocked as the player progresses through levels.

- These upgrades are viewable in the Recipe Book, along with their progression levels and the settings
 - Mockups of the Recipe Book can be viewed in the [Appendix](#)

Understanding the Problem Space

Understanding Virtual Reality (VR)

As we began our project, we first wanted to gain an understanding of Virtual Reality (VR) and its physicality. We started by playing different VR games to understand the feel of using the hardware and how that affects the user's gameplay experience.



Our main takeaways from this experience were:

- Introducing our team to how VR works and feels
- The 360° environment is a feature we should take advantage of
- Exploring what kinds of movement can cause motion sickness
- Getting inspiration of potential mechanics to incorporate into our game, such as grabbing motions or placement of items in front of you

Exploring more VR Games

VR as a whole has seen rapid growth in recent years, this means a lot of ideas have already been tested for us. We looked at existing VR games with mechanics similar to the ones we were considering to see what is already standardized, what works well, as well as what doesn't. We analyzed *Nountown Language Learning*, *Job Simulator*, and *Beat Saber* to draw insights that would inform our own game idea.

Nountown Language Learning	❖ Encourage pacing of learning content ➤ Doesn't overload user with too much information ❖ Speech recognition is 70% accurate of what player is saying
Job Simulator	❖ Game set up: cooking environment ❖ VR interactions with ingredients and equipment in order to cater to orders from customers
Beat Saber	❖ Our sponsor recommended we look at <i>Beat Saber</i> as it is the most popular VR game by far and includes simple mechanics that make it an easy game to pick up ❖ The simplicity of the game didn't leave room for us to make notable changes. ❖ The fast-paced nature of the game could easily be more stressful than beneficial for new players trying to build a basic familiarity with the language.

Moving forward, we took inspiration from the pacing of learning content from *Nountown* and the VR interactions from *Job Simulator* to help guide our ideation.

Japanese Pedagogy

We also spoke with our sponsors to see how students were being taught Japanese and what was the learning progression. The professor provided us with textbooks that covered the material students learned, as well as how the material is structured ([See Appendix A](#)).

One of the main things we learned was Japanese language pedagogy, and how there is an order to learning the language. Our sponsors introduced the learning path where new students would start by associating the two syllabaries of Hiragana and Katakana with **romaji**, which is the romanized spelling of Japanese. This helps those who are learning Japanese as a second language to connect Japanese characters with their respective sounds, through memorization and reproduction of these sound-shape associations. However as students progress towards learning Kanji and higher level material, the reliance on romaji should be lost as students should have developed a mastery of sound-shape association for characters.

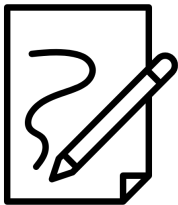
From this, we decided to lean away towards relying on romaji as our game would focus on current Japanese students who are already enrolled in a class and we didn't want an association with the romaji to trump the association with sound. However, if the students get stuck and just forget a certain sound/shape association for a character, we would provide a hint system that lets the user check the romaji. This way we can focus on mastery of sound recognition while making sure there is a way to make those associations easier for those who need help.

We were also given material of how students learned vocabulary, such as thorough mnemonic devices or using learned vocab in context phrases. This helped our team generate ideas on how we wanted to incorporate language learning into our game concept.

Ideation

Sketching

Our sponsors wanted a game that focused heavily on two aspects: **sound/shape association and writing characters**. From this, we divided our team into two groups that each ideated and sketched upon how to incorporate these aspects into game concepts. We looked into different genres/playstyles of games during this stage of ideation and explored concepts such as scavenger hunt, prop hunt, and “battleship.”



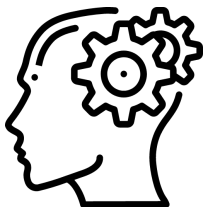
Sketching

Before we dived into sketching out potential game ideas, we took some time doing a **“Crazy 8” sketching activity** where we just sketched out components we wanted in the game in our two separate teams each focusing on a different aspect.



Key Components

After we sketched and labeled different components we wanted to include in **learning Japanese through VR**, we then affinity diagrammed our sketches to find common ideas and themes.



Design Rationale

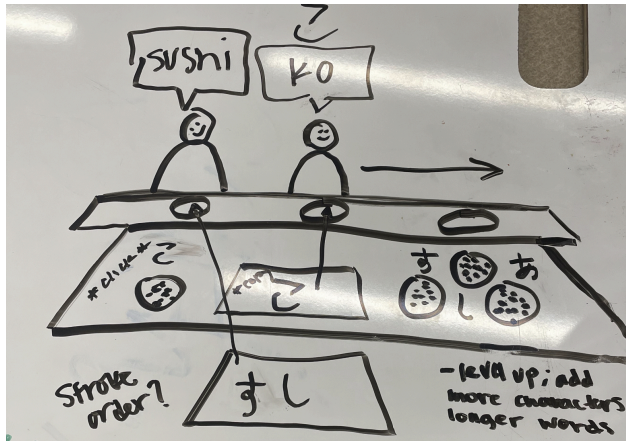
After looking at common ideas and themes within the VR game, we then looked into themes as a whole for **minigames** and what kind of style we should make it. This led us to another round of sketching between the two teams.

Narrowing Down

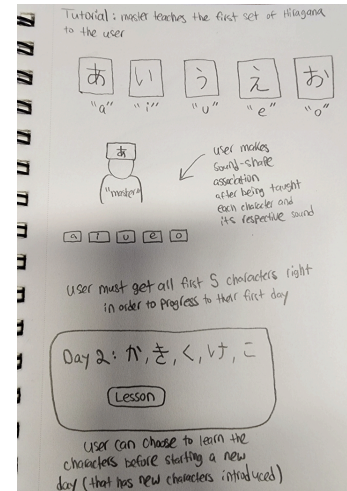
We narrowed down our ideas to two different games, **scavenger hunt** and **sushi tycoon**, as these were concepts that were able to incorporate different educational minigames within. To narrow down to one, we came together and did a round of sketching of both game possibilities and decided that we wanted to take a “sushi tycoon” approach, as there were more possibilities for our goals of improving

sound/shape association and writing skills. To move forward with our game concept, we recombined our split team to sketch on different learning games.

Example of Sketches



Writing Characters



Tutorial and learning progression

These two sketches are from our first round of sketches after deciding the theme of our game will be sushi tycoon. The sketch on the left shows the focus of the game being on writing and replicating Japanese characters. The sketch on the right shows how the tutorial would teach the user recognition of sound shape association by having flashcards above the sushi master's head. Both of these sketches were further ideated upon and included in some way in our final design choices.

Talking with Users

Interviews

Throughout the ideation process, we interviewed **five Purdue students studying Japanese** to better understand how they learn Japanese inside and outside the classroom. We also conducted concept testing with these users to receive feedback about the playability of our minigames.

We asked about methods or tools they used to learn Japanese, the struggles they faced learning it as a second language, and what has helped them succeed. Some insights we gathered from interviews were:

- ❖ Mnemonic devices are commonly used to remember characters
- ❖ Focusing on the differences of characters, rather than the similarities, helps with distinction
- ❖ Recalling the sound associated with characters quickly is a challenge
- ❖ Learning few sentences like introducing yourself

Concept Testing

With the Japanese learning students (our target user group), we showed the sketches we made to explain the concept of the proposed sushi tycoon game and asked for feedback.

Through concept testing, we learned that our game idea was appealing to our interviewees. Along with using words like “cute” and “fun” to describe their overall thoughts, they gave some specific suggestions to help improve the game. Some suggestions we received were to:

- ❖ Implement rewards to motivate users to play the game
- ❖ Include personalization features so users can set what characters/words will appear in the game
- ❖ Include listening (voiced by a native) or speaking element to help practice and remember accurate pronunciation

Based on this feedback, we included game rewards (tips, receipts) to help motivate, a recipe book to encourage unlocking new sushi recipes (refer to [Appendix](#)), and a daily special menu to allow users to personalize their game by choosing specific characters or phrases to practice more.

Diving Deeper

After the initial ideation and comparative analysis our team decided to sketch out ideas on how sound/shape associations and writing aspects could be incorporated into a game. We came up with multiple “tracing” game concepts to help with writing. Inspired by a few cooking games, we came up with concepts where players can learn Japanese while cooking or doing other fun and relaxing tasks. Our team also thought of multiplayer and single player game concepts. We noted down the main ideas from the sketches and sorted them into groups that had overarching game and play concepts.

This helped us narrow down our ideas and we voted on concepts and games ideas. Finally, we decided to create a sushi bar game, where the players would perform fun and engaging tasks to learn Japanese.

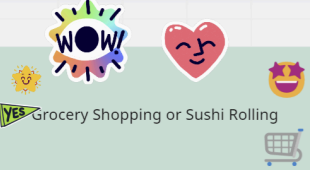
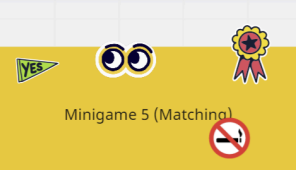
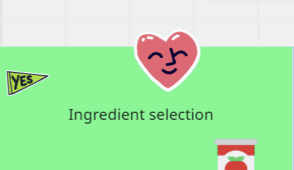
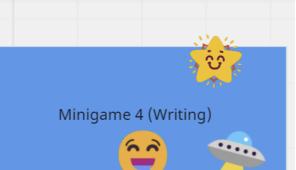


Mini Game Concepts

The main idea for the mini-games is to provide the players with goal based challenges, so they can track their progress on a daily basis. The games need to be engaging and fun, while incorporating the learning aspect through sound/shape and writing activities. We were also trying to figure out how these ideas can be implemented in a VR game environment.

From the ideation we did as a group, the game concepts we wanted to follow were:

- Grocery shopping mini-game where you shop for sushi ingredients, by making the right sound/shape associations
- Sushi chef making sound/sounds shape associations with ingredients and an order
- Garnishing mini-game that practices writing by having the user trace characters with a sauce bottle

 YES Grocery Shopping or Sushi Rolling	 Minigame 5 (Matching)	 Ingredient selection	 Minigame 4 (Writing)
- Grocery shopping for sushi ingredients - shopping list has sound, food item has characters - Roll sushi by saying the sound of the character that pops up, faster = better	- learning to match the shape of a kana with its romaji - to help beginners understand the sound relationship for hiragana and katakana	Order has a symbol, player is presented with several ingredients matched with a sound, they must select the ingredient with the sound that matches the symbol 	- teaching writing of the character before store opens - garnish on top of the sushi/character during the game to practice
Grocery shopping: shopping list -> click to hear sound -> recognize character from shelves -> pick up correct item	- player is given an image of a kana and has to choose the correct corresponding romaji spelling in an appropriate selection - examples of the selection would be "sa, shi, su, se, so" - the romaji can be associated with ingredients for the sushi but may prove to be confusing	- Order ticket w/ symbol - Ingredients with sounds - More tips for correct ingredients, upset customers & less tips for wrong ingredients	learning to write the character guides the user through each stroke with starting and ending points squeeze bottle of sauce use to trace characters over an outline of the character on the sushi plate 
- grocery shopping: get (new) ingredients -> possibly unlock new menu - practice speaking, listening->recognizing	mastering a selection of kana might include a reward system and encourage players to continue mastery	More tips to progress account	extra points/tips?
- Before the store opens, buying ingredients or - after making the sushi and needing to roll it for the customer	will most likely be incorporated with an order and players must match a certain number in order to get a bonus or avoid getting yelled at by customers	- Selecting ingredients to make sushi - Progression element	After making the dishes and plating it, write character as "garnish" on top. This game could give extra points to the chef.
Sound/Shape	Sound/Shape	Shape/sound association	Writing/stroke order
not picking up sound correctly when player is speaking	May be limited to more "advanced" students, aka students in high level courses. Varying ranges of difficulty?	If a sound is associated with the same ingredient a lot it may build up an association we don't want	Not sure if the character correctness can be graded in VR

Evaluation

We conducted three different evaluations for this sushi restaurant idea:



Paper Prototyping

Efficient way to understand the interactions and objects within the game.



Body Storming

Figure out the mechanics of the game and work through the storyline, onboarding tutorial, and each interaction.



Usability Testing

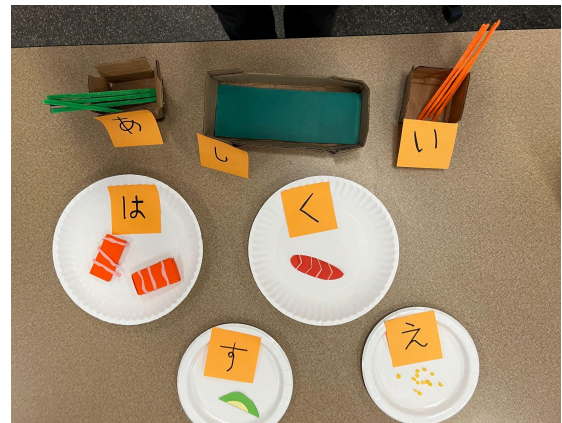
Getting peer feedback to find pain points and areas of improvement with our gameplay and story.

Paper Prototyping

While creating paper prototypes, we found certain items we wanted the user to interact with. Some specific goals we had in mind were to figure out the functional elements of our game, consider visual feedback, and attempt to simulate the hands-on VR environment.

As a team, we gathered materials to create the sushi and all its ingredients. We mainly used colored paper, cardboard, and wiki stixs to create our prototypes. We ended up making:

- Cucumbers
- Carrots
- Tuna
- Salmon
- Avocado
- Seaweed
- White rice



The team in action creating our paper prototypes

Body Storming with Physical Prototypes

Goals

With the use of our paper prototypes, the team decided to play the game ourselves to better understand the **flow** and the specific **interactions** within the game. At this point, we all had similar ideas of what we wanted to do in the game. A specific goal we had in mind was to all have the same understanding for the flow of the game.

Process

As a team, we started to set up all of our paper prototypes around the central table ring. We deliberated on what would go where, thinking of the best flow for the user. We then went through the gameplay flow for a typical day, assuming the player has already gone through the onboarding tutorial. We worked through each minigame and customer interactions.



Team member rolling and garnishing sushi



Team setting up our paper prototypes

From our body-storming activity, we gained the following insights:

- ❖ The customer will walk in and say their order. A pop-up will allow the player to request the customer repeat their order.
- ❖ The player will roll the ingredients together and sushi will magically appear because there were limitations with the mechanics in VR.
- ❖ The customer will give them back a receipt visually showing them what they did right and wrong. This provides feedback for the player to better learn and retain Japanese.

Usability Testing

Goals

Bodystorming as a team then allowed us to create a user testing protocol to evaluate our design. We tested with 5 of our UX Design peers. Within time constraints, we were not able to test with students learning Japanese from Purdue's Japanese language classes. With this testing, we wanted to make sure our game flow and instructions were understandable and observe any pain points and areas with room for improvement in our current iteration.

Process

Participants were asked questions before and after the main tasks of the game. Pre-task questions, similar to some of our interview questions, asked each participant about any prior VR gaming experience.

Testing then consisted of our participants watching the onboarding story, going through a tutorial, and then finally serving two customers on their own. The full protocol can be found in Appendix C.

While we encouraged participants to speak their thoughts aloud during their tasks, we also asked post-task questions to summarize their feedback.



From our usability testing, we gained the following insights:

- ❖ Users wanted feedback right away rather than waiting until the end.
- ❖ A hint system should be integrated for those struggling during the game.
- ❖ Including context-based vocabulary or phrases could help with real-life application of learning material.

Additional Documents



Along with this documentation, we created a **concept video** to demonstrate our game concept that will be delivered to our sponsor so that they may work with game developers to make our idea come to life.



Additionally, with the video, we prepared a **transition document** that details our game concept more in-depth for future game developers to understand our game.

Appendix

Appendix A: Sponsor Resources

Resources Provided

<https://one-taste.org/kanaex/index.html>

Writing System

わたし は がくせい です。

Watashi ha gakusei desu.

はです。

Teaching Order:

Hiragana + Romaji

Katakana + Romaji

Kanji (singular kanji meaning) + Hiragana(furigana) (、)

Kanji (kanji Word meaning) + Hiragana(furigana)()

Kanji words with hiragana combination(okurigana). E.g. 行きます

Kanji Readings:

1 Japanese reading (Kunyomi) 私 → わたし

2. Chinese reading (Onyomi) 私 → し (e.g.)

Appendix B: User Interview Protocol

Goals:

1. Identify pain points for students learning Japanese characters as a second language
2. Understand how students are retaining skills and information related to learning Japanese as a second language
3. Understand our users motivations for learning and practicing Japanese

Introduction:

Hi, thank you for taking time out of your day to speak with me!

My name is ___ and I'm a current student in the Purdue UX Design program. I'm working on a project with Professor Hatasa on how we can utilize VR technology to become a secondary resource to help students learn Japanese. Today's interview will be split into two parts, where the first part is an interview on your experience learning Japanese to understand language frustrations and what has helped you retain information. The second part of the interview will be asking you to evaluate a few game concepts that we have and what you think of them. Do you have any questions?

Just a disclaimer, the information collected from the interview will be anonymously used in our research. This will not be shared beyond the team. Is it okay if I record this interview?

And lastly, before I begin, do you have any questions for me?

Questions

Lead-Off:

1. **Can you tell me a bit about yourself as a student?**

Follow-up: How long have you been learning Japanese? What Japanese class are you in?

2. Why are you taking Japanese?

Follow-up: What do you find interesting about the language/culture?

3. Do you have any previous experience learning Japanese?

- *Backup: Or do you have experience learning another language before (not your native language)?*

Follow-up: Are there any useful techniques you've used to learn languages? How did you begin this process?

Main Questions:

Learn about their experience learning Japanese

1. Learning Japanese, what were some concepts that were difficult to understand?

- *Backup: What has been the most challenging thing to learn so far?*

2. Were there some characters that were more difficult to learn than others?

Follow-ups: How did you learn them/tell them apart from other characters? What made them more difficult?

3. What current methods do you use that are the most helpful when learning Japanese?

Follow-ups: Do you benefit from learning with a fellow student (group/partner learning)? What do you think helps the best with quicker recognition of characters?

4. Have you used any external tools (games, apps etc.) to aid in your learning of Japanese (or other languages)?

Concept Testing

Goals:

- Does the game sound fun?
 - Replayable

- Will it help people learn Japanese?
- Do the time-based tasks build interest and help in user retention?
- Introduce overall game ideation (sushi tycoon)

Introduce game:

- **Our idea is a cooking game where you own and operate a sushi restaurant. Players will interact with multiple minigames designed to strengthen their Japanese skills as they grow their business and progress through the game.**

Next, we're going to show you some of our ideas for different minigames. We'd like you to let us know:

- Do you think these would help you learn Japanese?
- Would it be effective for practicing?
- Do they sound fun?
- Do you think you would play these games often? Or come back to them to practice?
 - What incentives might you be looking for (effective, fun, challenging)?
- How would you go about improving them?

Appendix C: User Testing Protocol

Tasks:

- Show them the introduction video of Professor Hatasa
- Complete a tutorial
- "Guide" them through the tutorial, acting as the sushi master
- Speak aloud any thoughts/comments/suggestions

Goals:

- See if the flow of the game feels right
- Make sure the instructions are clear/make sense
- Note user frustrations and areas for improvement
- Observe habits and preferences

User interview data - second sheet "User Testing"

Questions (Pre-testing):

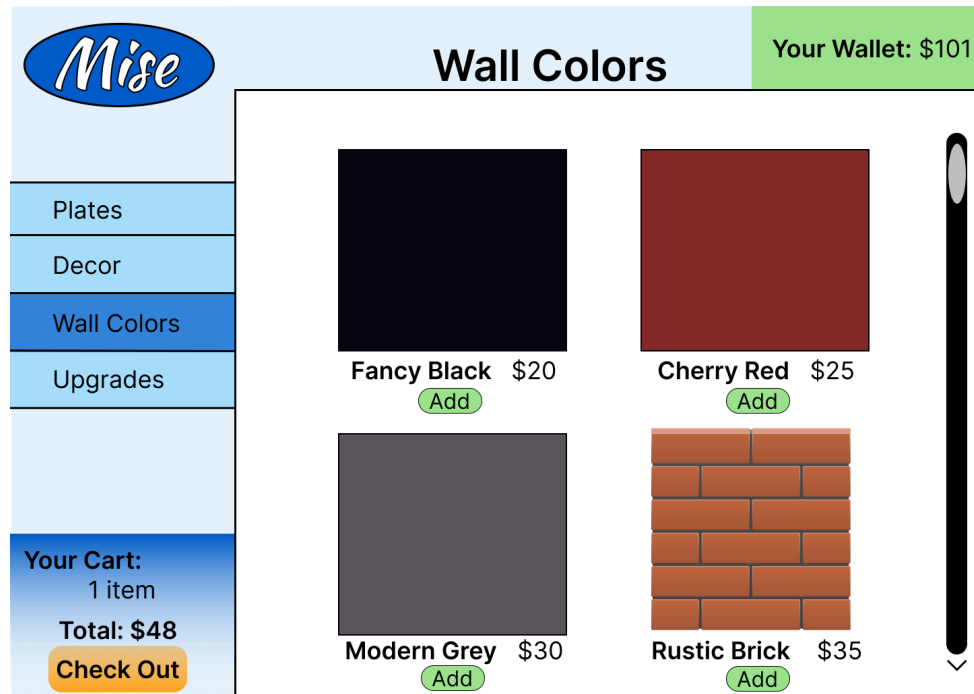
- Have you used VR before?
 - What did you do in VR?
- Have you learned a second language before? If so, did you play games to help?
 - What kind of games were they? (if yes)
 - Would you play games to help?
 - What would you hope to gain from a language learning game/what would you expect to learn/see in one?
- Do you typically play games (are you interested in games in general)?

Questions (Post-testing):

- Were there any points that were confusing or you needed additional help with?
 - What would make that less confusing?
- What benefits do you think come from learning in this way? Cons?
 - Do you see yourself using this to learn a language?
- Do you have any additions you would want to see in the game?
- Would you want to continue playing this game to assist in your language-learning journey?

Images

Upgrade Computer screen:



Recipe Book:

PROGRESS



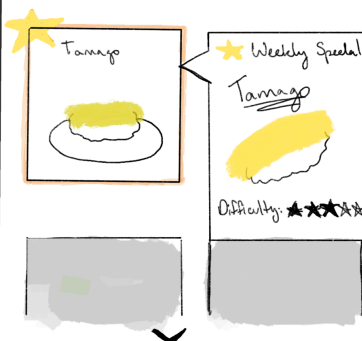
NEW WORDS LEARNED THIS WEEK: 7

すし - sushi
 卵 - tamago
 まき - Maki

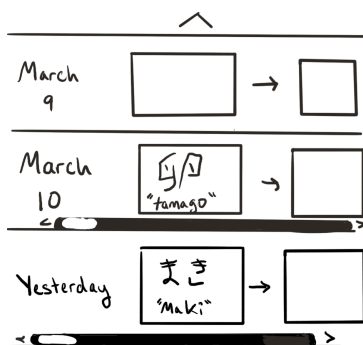
WORDS LEARNED TOTAL: 25

GO TO WORDS LEARNED PAGE

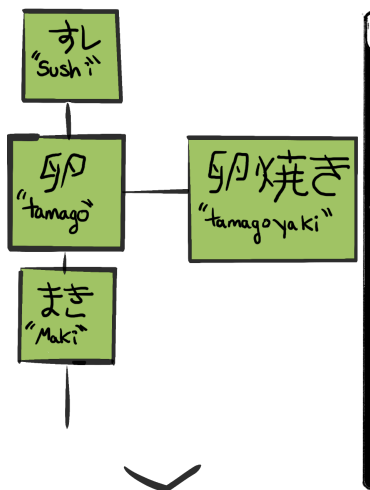
RECIPES



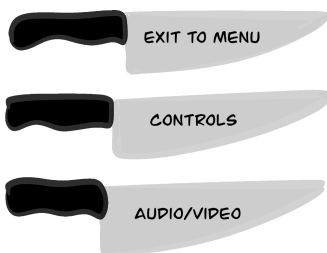
YOUR JOURNEY



WORDS LEARNED



OPTIONS



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