Card-IT Versus: A Competitive Multiplayer Game for Testing Italian Verb Morphology

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Abstract

Memorizing verb conjugations is a common challenge in language learning that can be a tedious and bland process. The Italian language in particular has a complex and rich verb morphology where a large number of linguistic features are present, namely tense, person, mood and number. Card-IT is a language learning application that we have previously developed with the goal to teach Italian verb conjugation through flashcards. This thesis presents a gamified extension to Card-IT called Card-IT Versus which aims to engage multiple students to learn together through competing in verb conjugation games. The games are based on the "Conjugate" and "Identify Tense" quiz types from the base Card-IT system. In the gamified version, players are to correctly answer a series of flashcard questions as fast as possible to maximize their game scores. These flashcard questions would be based on deck(s) that a player has organized for themselves in the base Card-IT system. During the game players can obtain a variety of 14 items that either assist them or sabotage an opponent. Items are a key element in Card-IT Versus as they are designed to make the experience frantic and help players who are not performing as well. Once all players go through all questions, the player who gained the most points wins the match. In order to implement this multiplayer functionality, new React.JS components and a Socket.IO server were added to Card-IT. Card-IT Versus should be evaluated in the future to determine if it is an effective way for students to find engagement and learn Italian verb conjugations.

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1 - Introduction

This section discusses the purpose and motivation behind designing this gamified language learning experience. The target audience is also discussed to explain who Card-IT Versus is designed for and what setting is appropriate for its usage.

1.1 - Motivation & Problem Statement

There are various resources for learning languages online. Learners may find the memorization process required in these language learning services to be dull and tedious. Our goal is to improvise this learning experience through gamification. According to Al-Dosakee, & Ozdamli (2021), gamification makes memorizing languages more fun, engaging and rewarding [1]. Therefore there is a greater incentive to memorize. Another attribute we noticed about online language learning is that it is a solo experience for the most part. If there was a way to learn with others during the game it would be even more engaging. We present a competitive multiplayer game where users will answer a series of questions that test verb conjugations. During gameplay users obtain items that either assist them slow down their opponents game. This game is built on top of the Card-IT[2] web application. This application tests users on Italian verb conjugations through flashcard memorization.

1.2 - Target Audience

The core audience are young adults who are learning Italian. Card-IT Versus would be a convenient resource for students to study together whether it be in a classroom setting or in a study group. Most students grew up with exposure to online games and probably found them engaging and enjoyable. Therefore adding online game elements into their language learning study has the potential to engage them further. Currently students are given worksheets from their teachers or use language learning apps such as Duolingo[3] to test their memorization of verb conjugations. These methods of learning successfully test the students memorization and the apps may feel game-like in terms of tracking progress. The students' need for engagement through online multiplayer is the feature that Card-IT Versus differs from other online language learning applications.

2 - Background

Card-IT Versus is a new system module developed on top of an already existing language learning application called Card-IT. Card-IT focuses on teaching Italian verb conjugation (morphology). Linguistic attributes in Italian such as a verb's tense, mood, person or number can alter the same verb in a greater variety of ways compared to other languages. While language exposure and practice ultimately is the best way to successfully acquire a foreign language, studies show that linguistic awareness also benefits the acquisition process [6]. Therefore, because verb conjugation relies on understanding those aforementioned linguistic attributes; Card-It focuses on increasing the learner's exposure to linguistic features while performing a familiar task of studying using digital flashcards. Usually language learning resources do not highlight these attributes as much as they should so Card-IT was developed in order to combat this issue. Card-IT offers a flashcard learning experience. Each flashcard will contain the verb and all of its related linguistic attributes.
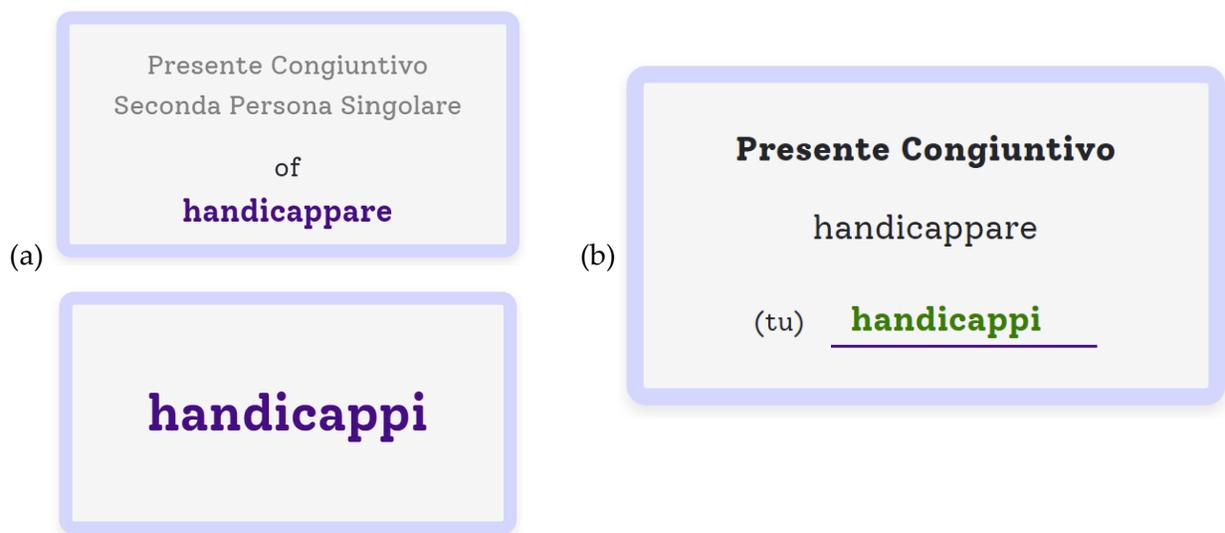

Figure 1: *Two study types: a) Flip mode b) Spell Conjugation mode this is also the format of questions in the Conjugate quiz type.*

Users can build and organize their own decks of flashcards to study and quiz themselves on. In order to add cards to a deck you can go to the Verb Search page to search for a verb you would like to add. This search can be furtherly specified by filtering the search by linguistic attribute (tense, mood, person, number). Users can study flashcards through two views. There is a "Flip" view where the verb in its infinitive form and its related linguistic attributes are shown. If the flashcard is hovered over, the card will flip revealing its conjugated form (Figure 1a). The "Spell Conjugation" view shows the verb's tense and pronoun and allows the user to spell the

conjugated verb within an input box on the flashcard (Figure 1b). After the user presses the Enter key the text will turn green if spelt correctly and red spelt incorrectly along with the correct answer.
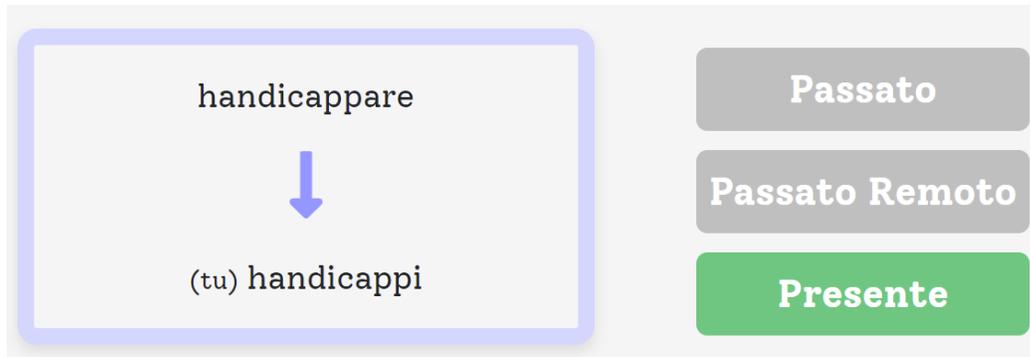

Figure 2: *Identify Tense quiz type, where the user must choose the appropriate tense that transforms the infinitive verb on the top of the flashcard into the conjugated verb on the bottom.*

There are three quiz types the users can choose from. The first type "Conjugate", tests users in the same format as the "Spell Conjugation" (Figure 1b) study mode but they only get one try and must go to the next question once they have answered. The second mode is "Identify Tense" where the user must identify the tense that is responsible for the conjugation (Figure 2). This quiz presents a flashcard that contains the conjugated verb and its pronoun. The user can select from a multiple choice of three different tenses. The correct choice will be highlighted in green and if the user chose an incorrect choice it will be highlighted in red. The third mode is "Mixture" which randomly selects whether your next question is going to test you in the "Conjugation" mode or the "Identify Tense" mode.

3 - Related Work

This section showcases works related to Card-IT Versus such as language learning games/projects and literature that highlight the positives of gamified language learning.

3.1 - Effects of Gamification in Language Learning

Research done by Al-Dosakee & Ozdamli (2021) suggests that gamification in language learning transforms traditional language learning from being uncomfortable and unpleasant into a more enjoyable process [1]. They state that modern technology is becoming increasingly dominant and that it provides a fresh environment for language learning. Young adults are usually the target audience as they tend to be more comfortable in using it.

Increased learner motivation, engagement, participation and loyalty have been found in various studies that tested the effectiveness of gamified language learning applications. According to Al-Dosakee, & Ozdamli (2021), to achieve these positive results, it is essential for these games to have a fun sense of challenge that continues to entertain [1]. The aforementioned research also pointed out that implementing game elements such as leaderboards, competition, badges and points are common solutions added to these applications that increase user engagement. Card-IT Versus has some of these game elements such as competition and a point system. An element that helps Card-IT Versus stand out would be its items as those are not a typical game element found in language learning games. The combination of competition, points and items were crucial in designing it to be an ever engaging and unique gameplay experience.

3.2 - Gamified Language Learning Applications

This subsection discusses some language learning research projects and commercial applications. These applications have similar design goals and approaches to Card-IT Versus. Some have more novel gamified approaches than others. Regardless, they all are worth considering in developing a language learning application.

3.2.1 - Research Projects

In a research project done by Ling et al., a competitive language learning game was developed and evaluated [10]. The game involves a student playing against an automated agent in translating sentences from their first language into the language they are learning. It is designed to improve students' vocabulary and writing skills. The agent's performance in the game is

based on statistical machine translation outputs designed to emulate human-like performance. Each game has a number of rounds which present a new sentence to translate and players take turns to guess a new word for the translated sentence. Points are gained when a word is guessed correctly and a few points are lost if guessed wrong. There is an element of strategy to the game as players can answer easier words first to leave the harder ones for their opponent. Once the sentence is fully translated, the player with the most points wins. Participants can either play this game solo or against an agent. If playing solo, the goal would be to achieve a high score. This option was provided to see if students prefer playing alone or against the agent. A similar comparison should be done in evaluating Card-IT Versus since it also has traditional and gamified learning methods that are worth comparing. The translation game was evaluated on 20 Portuguese learners of Mandarin. They were more focused and motivated when playing with an automated agent compared to playing alone. This supports the idea that students can be motivated to learn through the engaging game that Card-IT Versus potentially has to offer. Essentially participants found it to be an enjoyable learning experience. However, those who had skills up to par with the agent had more enjoyment. Therefore, they are interested in developing an agent that would adjust to the same skill level as the player.

A research project done by Yükseltürk et al. developed a Kinect[9] based game that aims to improve an English learner's self-efficacy beliefs and attitude towards the language [22]. It is also designed to improve various language skills including reading, writing, listening and speaking. The game puts them in a series of gamified scenarios that simulate what they may face in real life if they were a European exchange student and had to navigate the country using English. Tasks and experiences such as traveling, renting a house or finding a part-time job are simulated within the game. During the game players collect points by fulfilling subtasks within these tasks. These points can then be used to buy in-game traveling and home expenses or to advance in the game. The evaluation was conducted with two groups of about 30 students each attending the same English course. One group was just given access to traditional learning methods and the other had access to the traditional and gamified methods. A post-test and a pre-test was done to test the before and after of the self-efficacy and attitude of the students. After comparing the performance of these tests it was found that the group who participated in the games had improved self-efficacy beliefs in specifically listening and speaking English. Reading and writing skills were about the same for both groups. Due to this study immersing students in different life-like scenarios it is natural for the confidence of audible/oral communication to increase. Card-IT Versus aims to immerse students in the conjugative aspect of language learning so gamifying it would help students be more confident in that aspect.

3.2.2 - Commercial Applications

Duolingo is a popular language learning app that helps users learn through spaced repetition. Some of the questions that it offers involve testing the user's ability to listen and decipher the pronunciation of words as well as translating sentences from one's native language into the language they are learning. It is a traditional language learning app but it does have some game elements such as daily engagement streaks and competitive leaderboards. The more you practice lessons in the app, the higher you climb up the rankings. These game elements have been proven to increase motivation and user engagement in learning applications [1]. Similar to Duolingo, Card-IT Versus is competitive. However, Card-IT Versus is designed more around competition as players can interact with each other in a more direct and synchronous way. Our emphasis in competition is required in our case as Card-IT Versus is meant to be more gamified.

Tinycards[20] by Duolingo is a discontinued flashcard learning app for memorizing various topics (not just languages). Lessons were offered in a flashcard format and used spaced repetition. Users could study from over 200,000 flashcard decks or create their own decks to study from. User created decks can also be shared with friends. Tinycards include memory strength bars that indicate how strong a user's memory is on each topic. They are kept full by consistently reviewing and refreshing their memory on the topics. Once a user has mastered a topic a new level can be unlocked within it that offers a greater challenge.

Memrise[12] is another language learning application that teaches new vocabulary and phrases through spaced repetition. The pronunciation of words are learned/listened to from short videos of native language speakers pronouncing them. This is designed to immerse learners into the experience so they feel like they are in the environment where the language is spoken. Users also have the ability to customize the length of lessons and learning sessions so they can fit them into their schedule. Memrise offers community features where user generated courses can be shared and study groups can be made. User generated courses can be related to various topics related to different hobbies and interests which is a great opportunity for learners to expand their vocabulary further.

Both Tinycards and Memrise offer a way of creating and sharing learning material with friends or the community. Similarly in Card-IT Versus, players generate flashcard questions based on decks that they have organized for themselves. Some or all verbs within the deck chosen by the game's host may be new and unfamiliar to other players. Also an unfamiliar flashcard may be shared if a player sends their current flashcard question to another player by using the Mail

item. This provides players the opportunity to discover unfamiliar verbs and test their conjugation skills on them.

Influent[7] is a language learning video game that teaches vocabulary and pronunciation through an explorable and interactive 3D virtual house. They can choose from a variety of over 20 languages to learn from with more to come in the future. Players can freely roam the environment and select whatever objects they are interested in learning. Objects contain information about whether it is a noun or a verb or if it has associated adjectives or descriptions. Objects that are studied are organized into a list that can be referred to and be used in a mode called Seek and Destroy. Seek and Destroy involves controlling a mini spaceship that can shoot lasers around the house. The game will announce the names of objects from the players list and the player has to recall the name of them, fly the spaceship to its location and shoot it down. Similar to Influent, Card-IT Versus asks users to recall a previously organized series of flashcards in a frantic game environment.

3.3 - Game Design Inspiration

There are competitive multiplayer games that have inspired this project which do not aim to teach languages. Elements of their game design have been broken down to be applied into Card-IT Versus' in some fashion. Games where players can sabotage another's game experience have been especially noteworthy.

The Versus mode in Tetris[19] games consists of two players trying to quickly solve their own Tetris puzzle. Puzzles are solved by clearing blocks off the screen by placing falling blocks into crevices. Once a player solves a part of their puzzle, the other player's puzzle gets ruined by getting more blocks to clear off their puzzle. The idea of transferring obstacles like this inspired Card-IT Versus' Mail item. The more efficiently a player solves a part of their puzzle the more the other player's Tetris puzzle would be sabotaged. This design inspired Card-IT Versus' reward system for answering questions faster.

Mario Kart[11] games involve a go-kart race where items can be obtained. Items can then be used to assist the player or attack other opponents. When attacked by an item, players would be stalled for a certain period of time and would have a greater chance of getting hit by the item depending on its severity. For example, there is a higher chance of getting hit by a Red Shell item compared to slipping on a Banana Peel item. Players that are behind in the race obtain better items that are designed to help them advance and catch up. Players that are in the front will obtain items that are less powerful but still help in maintaining their superior placement. The use cases and distribution of these items are similar to how items are implemented in

Card-IT Versus. This design helps balance the game so that players that are not as skilled still have a chance at attaining a higher placement in the race, even if it is just temporarily. Surviving these items tests a player's resilience and willpower to win the game.

Jackbox Party Pack Games[8] have an assortment of five multiplayer party games. One of the party games found throughout the series is Murder Trivia Party. This game involves asking players random multiple choice trivia questions. There are cases in the game where the multiple choice questions are harder to read in order to slow down or throw off players. For example, the font can be made very small, vowels are replaced with hashtags or words are flipped upside down. This kind of character manipulation has inspired some ideas for Card-IT Versus' items, such as the Burn, Spin and Unscramble items.

QuizUp[15] was a game designed for mobile devices that is now discontinued. It offered many multiple choice quizzes based on a large variety of trivia topics. Players would verse other random players or friends online to compete in correctly answering these quizzes. More points are rewarded the faster one correctly answers and the player with the most points wins the game. As players quiz themselves on a specific topic they would gain experience points that would progress them to higher levels of the topic. This signifies a player's expertise of the topic and more challenging quizzes would be tailored to them. Gaining more points by correctly answering questions fast is the key in winning a game of Card-IT Versus as well.

4 - Game Design

Card-IT Versus involves multiple players. The goal of the game is to answer a series of questions correctly as fast as possible. The faster the player answers a question, the more points they are awarded. The type of question will either be based on the "Conjugate" (Figure 1b) or "Identify Tense" (Figure 2) quiz type depending on what quiz type the game's host has chosen. At least two players are required to play but a range of three to six players is an estimated range that we recommend. This range would result in a good variety in item distribution as well as competition. However, an appropriate number of players has yet to be determined through testing. We thought designing the game with multiplayer would give the game a competitive element and would give players more purpose to succeed. This could potentially yield us interesting feedback, experiences and results if this were evaluated.

Figure 3: *The Card-IT Versus game interface. The flashcard question is in the center. Item inventory is on the left. Obtaining items through betting points or the time trial is on the right. The status bar on the top shows tim with 200 points and shawn with 100 points. tim is winning because he has more points.*

The Card-IT Versus game interface has the current question in the center. The left has the item inventory that can hold up to two items. The top has the status bar to show the status of players. On the right players can gain items through betting points or a time trial event (Figure 3).

4.1 - Game Initialization

Figure 4: *Flowchart of using Card-IT Versus from game setup to finishing a game.*

In order for players to connect one must create a game room (Figure 4). Once created, a code will appear that gives access for other users to join. The code is generated from the first six characters of the host's socket ID generated from the Socket.IO server. The generated code would be easy to remember as they are alphanumeric with the occasional underscore or dash. The room code can be shared with other players using any means, such as chat, text, or speaking it aloud when playing in the same place. Within the room, the room's host can choose decks from their collections to use for the game and the quiz type ("Conjugate" or "Identify Tense"). Additionally the host can choose if all players will play with decks of the host's choosing or if every player gets to choose decks from their own collections. These options are named "Same deck(s)" and "Different deck(s)" respectively. In the case "Different Deck(s)" is chosen, each player's quiz will be based on their own material. However this does change during the game once Mail items are used, which will be explained in the Different Deck(s) subsection. Regardless of game mode, players who are allowed to select decks can choose one or more decks from their collections to increase the amount and variety of flashcards in the game. By default the Quiz Type is Conjugate and the players are using the same decks as the host. Before a game, flashcards are shuffled to increase variation on the order they show up. This way players can not be conditioned or rely on memorizing the order the questions appear in to help them.

4.2 - How to Win

The winner of the game is determined by who has gained the most points. Points are gained by answering questions correctly. The faster a question is answered within a 10 second time period, the more points will be gained. The calculation done for the points gained is the countdown from 10 multiplied by 100. For example, if a player correctly answers a question with 6 seconds to spare, they are rewarded with 600 points. If the player takes longer than 9 seconds to answer the question correctly they are still rewarded with 100 points. No points are rewarded if a question is answered incorrectly.

4.3 - Items

During the game players can obtain a variety of 14 items, but can only hold up to two at a time. Items are represented by an emoji. This was a convenient choice as most item concepts had an emoji that would match its ability. Emojis are also strings so they are easier to implement than images. The only exception is the eraser icon which is from the FontAwesome library. Items will either assist the player or sabotage an opponent's game. The functionality of these items are divided into two categories, Assist Items and Offense Items respectively. In the case an offense item is used and there are more than two players, a random player will be chosen to receive it. If there are only two players the only other player will receive it.

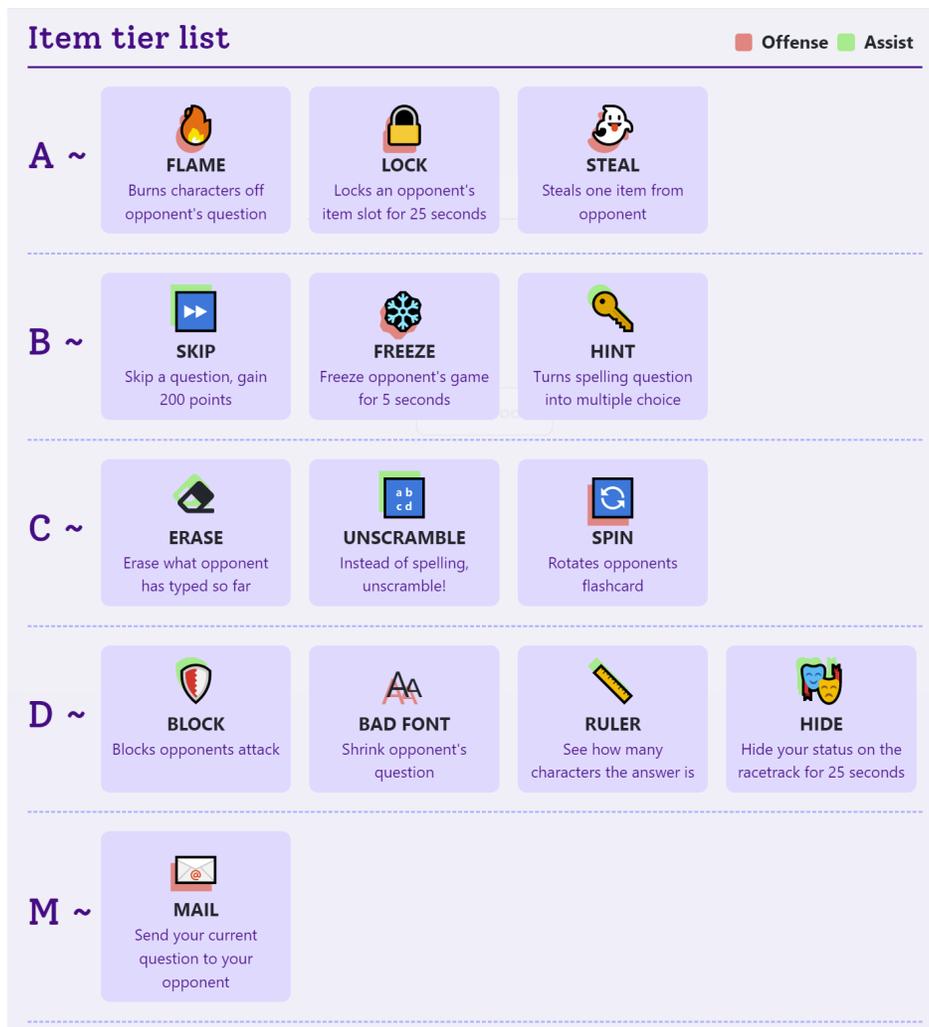**Figure 5:** *This is the item tier list which can be found in the Rules section. Within the A - D tiers, items with higher impact are towards the top and items with less impact are towards the bottom. The mail item is easy to obtain regardless of a player's amount of points so it's separated from the A - D hierarchy. Items with a green shadow are assist items and items with a red shadow are offense items.*

The level of impact that certain items have is divided into tiers, descending from A - D (Figure 5). The Mail ✉ item has its own separate tier, M because its distribution will occur more evenly in the case that players are playing with different decks (mode will be explained later). Items add a much-needed layer of complexity to the game as they are the main feature that transform the traditional quiz into a game. Items offer a frantic way for players to interact. Certain items are designed to specifically affect what a player is typing in the input box for the Conjugate quiz type. They have no use in the Identify Tense quiz type so they will not be obtainable when it is chosen.

4.4 - Obtaining Items

There are three ways to obtain items, from a random drop, betting points or through winning a time trial. Typically, a randomized item can be obtained after a question is answered correctly or incorrectly. Players have a higher chance of receiving a drop if they are performing poorly and lower chance if they are near the lead. Additionally, players that have less points will obtain better items (from the A and B tiers) and will have a higher chance of obtaining them. The opposite is the case for players who have more points. This rule is applied to random item drops and betting points. Time trials break this rule. Once a player receives an item it is stored into a slot in the player's inventory located on the left of the page (Figure 3). An empty item slot has a light blue background. An item filling one of the slots will either have a green background which would signify that it is an assist item or a red background which would signify that it is an offense item.
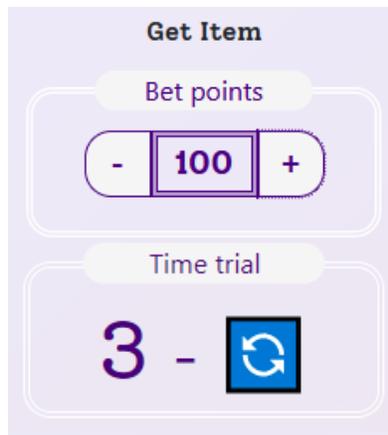

Figure 6: *On the top users can bet points to have a higher chance of gaining an item drop for the next turn. On the bottom is a time trial event. There is a countdown and the item that would be awarded if the player answers before the countdown ends.*

The other ways of obtaining items occur less. These methods are provided on the right side of the page in the Conjugate quiz type. The first one is called Bet points. This is for players who are willing to sacrifice some of their points in order to increase their chances of an item drop after they answer their current question. The more points that are bet, the higher chance they will obtain an item. However, this bet is only applied if the player answers the current question correctly. The second method is called Time trial. This is an event that has a 1 in 8 chance of occurring once the user moves to a new question. Here the player is rewarded with a random item from the B, C or D tier if they answer the current question within 5 seconds (Figure 6). This could cause a bit of chaos as it gives the opportunity for players who are doing better in the game to have access to the higher B and C tier items rather than the usual D tier. A tier items are excluded from the Time trial to ensure that the game does not become overly chaotic. The potential item is shown with the countdown next to it. This way the user can anticipate the item that they are about to be rewarded with.

In the "Identify Tense" quiz type players can only obtain items through random drops. In "Identify Tense", questions are multiple choice which makes it easier than the Conjugate quiz type. Therefore, having fewer opportunities to obtain items does add some extra challenge to balance the game. Additionally the area for the multiple choice options is where the Bet points and Time trial sections would be. Placing the multiple choice options and these sections there at the same time would look cramped and complicated for players. The idea of toggling between these sections has been considered but it has been decided that it is still complicated. It is best for players to prioritize speed as toggling can make players lose their flow. Ensuring a simplified user-interface avoids this unnecessary frustration.

4.5 - Controls

Players can progress to the next question by clicking the Submit button on the bottom of the page. Items are used by clicking the desired item encased in one of their item slots. This is a traditional approach that is easy to understand. However, in the case of the Conjugate quiz mode there would be lots of swapping between the keyboard when typing the answer and the mouse when choosing the Submit button or item slots. This swapping can be tedious and annoying in a game that requires speed. In order to quickly use items and move onto the next question, we thought keyboard shortcuts would be a suitable option to have. Players can press 1 to use the top item and 2 for the bottom item. The Enter key is used to move to the next question. Card-IT Versus is only designed for desktop browsers so keyboard shortcuts are compatible with its intended hardware. These keyboard shortcuts are mentioned in the Rules section of the game setup.

4.6 - Viewing the Status of Others

Players can see how far others are in the game on a slider on the top of the page (Figure 7). The range of the slider is based on how many questions there are and its thumbs represent which question players are currently on. The thumb that a player is on will show their current status, the player's username and how many points they have. A player's status would be determined by what item is currently affecting them and it is represented as an expression/face emoji. For example if a players game is frozen, their status would be 🥶.This slider functions similarly to a racetrack. However, how far one is in the game does not necessarily correspond to how well the player is doing. The amount of points beside the player's name would signify that. We thought showing player statuses would make players feel that others are playing the game with them and that everyone is experiencing their own ups and downs. Also it could be used to strategize when to use an item against an opponent in the case there are only two players. For example, if a player wants to stack the effects of multiple items on their opponent they would know to use an item if their opponent's emoji signifies that they are having trouble. For instance, if an opponent's status is 😵 it would mean that they are being affected by the Spin item. Using another offense item against the opponent while they are dealing with the effect of the Spin item would give them an even harder time. Alternatively a player could plan to use an offense item on a player who has just finished dealing with one in order to extend the duration of sabotage. This strategy can be considered when there are more than two players. However, due to the system choosing a random player to attack, players will have to hope that their offense item reaches who they want.

Figure 7: *Two players on the status bar. shawn2 has 200 points and has neutral status, so he is not being affected by an item. shawn has 100 points and has a nerd face as his status meaning he is using an item such as Ruler or Unscramble to assist him. The glasses signify that he is seeing the question differently. shawn2 has more points than shawn, meaning that shawn2 is winning the game so far.*

4.7 - Different Decks

If the option to play with different decks is chosen then each player must choose a deck or decks from their own collection. In this mode the possibility of obtaining a Mail 📧 item is enabled. When a player uses the Mail 📧 item, their current question is sent to another random player. This gives the opportunity to slow down other players as well as help them learn verbs that

they are unfamiliar with. In this case the amount of questions required to complete the game session will probably end up being varied between players. This would be due to the different decks varying in size and some players may receive more Mail ✉E questions than others. Each player has a status bar with a range that is relative to how many questions that player has. Therefore a player can finish their game in the middle of another player's status bar if they have less questions. So in this mode, making it to the end of the status bar does not necessarily signify that a player went through all their questions. In order to combat this, once a player has finished all their questions their status switches to 🚩.

4.8 - Results & Final Scores

Once a player has completed all their questions they will see a results page with their final score and all the questions they answered correctly, incorrectly or skipped. Once they are done reviewing it they go back to the game setup where they can wait for other players to finish to start a new game. The list of players in the room is now ordered based on who has the most points in the game. Their amount of points and current status in the game can be viewed here as well. Once a player is finished their game their status becomes 🚩. Once everybody reaches this status players will know that everyone's final points are set and that they will be ready to start a new game soon.
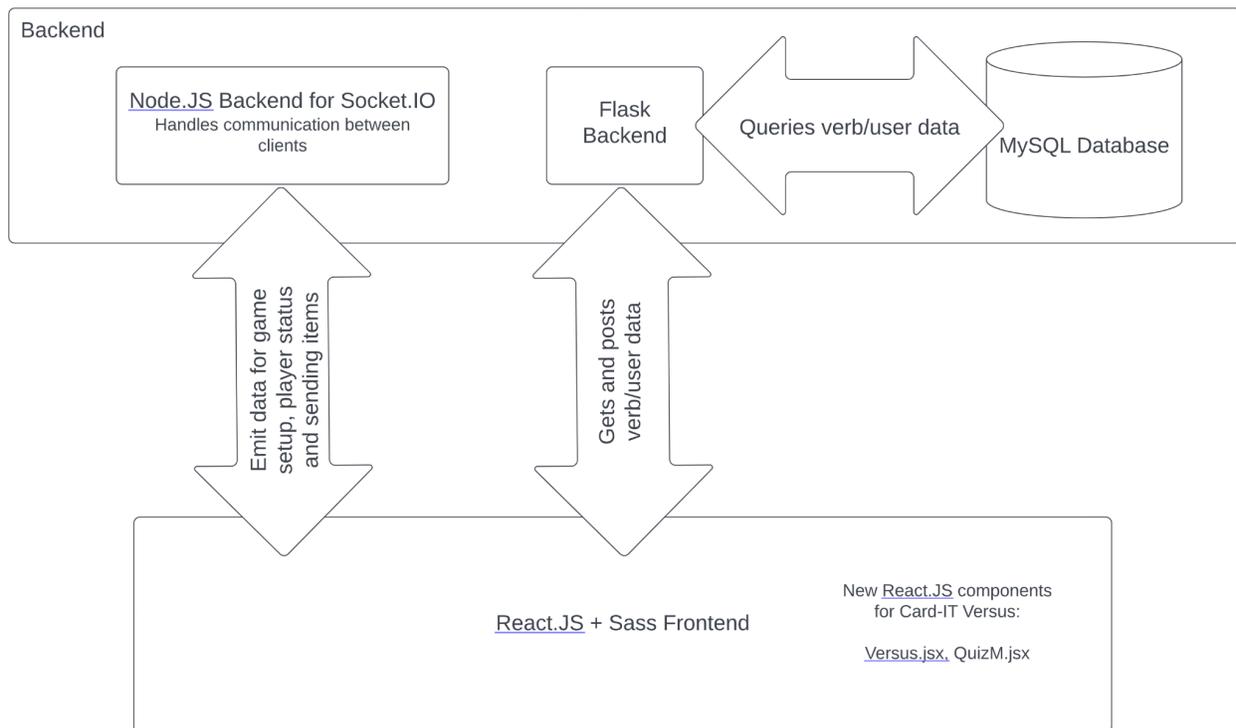
5 - Implementation

Figure 8: *Diagram of the Card-IT Versus system architecture.*

Card-IT Versus is built on top of the Card-IT web application. Card-IT's frontend was built with React.JS[16] and its styling was done in Sass[17]. The backend for querying all of the user and flashcard data was done in Flask[4] and MySQL[13]. In order to add communication between clients for the item exchange and game setup we integrated Socket.IO[18] using a Node.JS[14] server. Card-IT Versus adds a few major React.JS components to the project, namely the Versus and QuizM components (Figure 8).

The Versus component is the first component that is activated once the user navigates to Card-IT Versus from the navigation bar. It allows users to join or create a game room. Once a room is entered it then handles game settings such as which quiz type and what decks are being used for the game. The names of players and their statuses are also displayed here. It has two child components, one for viewing the game rules and another for selecting flashcard decks to play with. Once a game is started the QuizM component activates.

The QuizM component is a heavily altered version of the original Quiz component. Logic for generating a random item as well as the item exchange between players is handled here. All the information related to items including their name, emoji icon, tier, description, the status they

grant and which type of quiz they can be used in are all saved in a JSON file called `items.json`. The QuizM component accesses this file to randomly generate an item from it.

The QuizM component includes various child components that hold different elements of the user-interface. These child components include the status bar, item inventory, betting points/time trial and the current flashcard question. The component that holds the current flashcard question called FlashcardForms was also in the original Quiz component. In order for the flashcard question to be altered through certain items such as Burn, Spin and Ruler it was updated to accept them.

In order to apply a game-like atmosphere to Card-IT Versus all of its components share a background that fades between a light blue and light purple color gradient. The user-interface elements have a white background that's slightly transparent so users can still view the gradient background a little. Overall the variance in purple makes Card-IT Versus more lively. This encourages players to be more alert for what is about to happen next in the game.

Later in the course of development an alternative approach that would result in a more concise implementation was realized. The Socket.IO implementation could have been done more concisely by implementing it within the Flask server by using the Flask-SocketIO[5] package. This would eliminate the need to have the Node.JS server that just handles Socket.IO. Handling all of the backend in Flask would make the system more clean, formally structured and easier to deploy.

6 - Evaluation

Ideally, an evaluation should be conducted to measure if Card-IT Versus helps students effectively learn Italian verb conjugations and if they enjoy the gameplay experience. While it is out of the scope of this thesis, in this section, we will discuss potential evaluation plans and methods.

The goal for the evaluation is to check if players are truly engaged in the game and if they prefer it over studying using traditional Card-IT quizzes. In partnership with a teacher, a basic evaluation would require at least one classroom of students who are learning Italian. Students would be assigned the same flashcard decks to study over the course of a week or two. Half of them would study them through the base Card-IT system and the others would be able to study with the Card-IT system that includes Card-IT Versus. See a sample layout of the groups of students in Table 1. All of the students' results would be recorded so we can compare which group is answering more accurately. Besides the quiz data analysis, we can apply a test before Card-IT and Card-IT Versus are introduced, then the same test can be used at the end of the period. In this way we can assess their starting knowledge and their progress after the usage. Another option would be to have no entry test and just give a final traditional assessment based on the flashcard decks they studied. In this case, we can compare both groups of students, but we will not have data about their test performance prior to being exposed to the system. In either case, we can compare whether the original Card-IT or Card-IT with Card-IT Versus helps students memorize Italian verb conjugations faster and more accurately.

Group	Base Card-IT system	Card-IT Versus system
Initial Evaluation (optional)	Traditional pre-test on Italian verb morphology	Traditional pre-test on Italian verb morphology
Assigned system attributes	Organize decks, study using Flip and Spell Conjugation, Identify Tense and Conjugate quizzes	Organize decks, study using Flip and Spell Conjugation, Identify Tense and Conjugate quizzes Card-IT Versus - participants can verse each other in gamified Identify Tense and Conjugate quizzes
Exit Evaluation	Traditional exit test on Italian morphology	Traditional exit test on Italian morphology
Exit Interview	Questions related to learning experience, engagement and usability	Questions related to learning experience, engagement, usability and gamification

Table 1: *A comparison between the different study groups in the Card-IT Versus evaluation.*

To focus on usability and engagement of the systems, after the final test and evaluation period, we can perform a semi-structured interview with the students to ask them about their experiences using both systems. Naturally, there would be more questions to ask about the gamified version as this is the main subject of the study. Participants who tried Card-IT Versus would be asked if they prefer playing the game over doing the traditional quizzes and if they feel like they are learning while playing. Additionally, usability related questions would be asked. For example, if it was easy to catch on to the functionality of the items just by looking at their emoji icon and name. Another one would be if the pacing of the game is appropriate for learning and studying. It would also be worth asking them if there are any ways that the game design can be improved. Perhaps, certain items could be found as overly intrusive. Overall, receiving insight from the learner's perspective would be a great opportunity to improve the game design and discover new ideas for future work. Here are some sample questions for the evaluation:

- **Do you prefer studying through the traditional quizzes, Card-IT Versus or a mixture?**
- **Is Card-IT Versus fun and engaging?**
- **Did you find the items easy to understand?**
- **If you were to change something in Card-IT Versus what would it be? Any suggestions?**

In terms of accessibility and fairness to students, we would like to make both versions available post-study. For example, those who only studied using the base system, can be asked if playing a gamified version would interest them. Even giving them a quick trial of Card-IT Versus after they are conditioned to study using the base system may result in some differing feedback.

7 - Limitations

Card-IT Versus is an expanded version of the original Card-IT application. It inherits its limitations regarding the learner audience, but it also has technical design limitations of its own. As of now Card-IT only supports learning Italian verb morphology to English and German speakers. This limits the audience to those who are only interested in learning Italian. In order for Card-IT Versus and Card-IT as a whole to reach a wider audience, different languages and linguistic information should be added.

Given its design motivation, Card-IT Versus can not be played by solo learners. It is strictly designed around the multiplayer experience, so at least two players must be active to commence a game. On another note, because Card-IT Versus is hosted online, it utilizes networking to enable communication between players. Thus, Card-IT Versus is bound to all the limitations inherited by this technical design. A strong internet connection for accessing the website and maintaining fast communication between players is required. Card-IT Versus performance has yet to be thoroughly tested with players in seperate locations which would entail different internet speeds.

We also need to acknowledge usability and adoption issues. New players or players who are not as familiar with video games may tend to take time to catch on with Card-IT Versus' mechanics. In particular, understanding and remembering what all the items do could take time to get used to. Just by looking at the name and icon of the item is not necessarily enough context to fully comprehend what the item does. We tried to mitigate this by adding a Rules page for players to review what all of the items do. However, this would be easy to forget as there is a large roster of items. The optimal way to get used to the items is to play multiple games until one gets a taste of the various circumstances where they could use or be affected by items.

The design of the status bar may cause confusion to some players as it may be misinterpreted as a racetrack. Players that have answered more questions are positioned further to the right of the slider which could look like they are winning a race. This is incorrect because having more questions answered does not mean that they have been answered correctly. Points are responsible for signifying how well a player is performing as they are gained through correctly answering questions. Therefore, the points next to a player's status would indicate how well they are doing. The position of the player's status is really designed for players to know how many questions their opponents attempted, just to see how they are doing. This may not be apparent to new players though.

Card-IT Versus and the Card-IT system's core user-interface is designed to only be usable on desktop browsers. Mobile support has yet to be realized. In order to enable mobile compatibility, the layout for Card-IT Versus would have to be drastically rearranged. There are various user-interface components to take into consideration such as where to position the item inventory slots and the Get Item section. There is also an annoyance that would come from the keyboard popping up and down for everytime the player would want to input something in the Conjugate quiz. Keyboard shortcuts would not work properly either so the game would not have the same seamless flow as desktop. Perhaps implementing a Wordle[21]-like keyboard would be a solution. Regardless, it would require great dedication to achieve a clean mobile interface.

8 - Future Work

Card-IT Versus offers a solid gameplay experience but there are smaller features that would make the experience more communicative and convenient. In order to prioritize the development of the core gameplay these complementary features were not implemented. However, they are worth considering for continued development. Common communication features seen in online games including a text messaging box on the bottom corner or a taunt option could be worth implementing. Players may already be using a messaging app (i.e. Discord) to communicate but having the option to communicate within the game may increase convenience at times. Additionally, it is common for players to have some senseless fun in a minimalist messaging box on the side.

Implementing taunts would be worth exploring as it is another source of senseless fun. If players can send certain Italian phrases or emojis to taunt others it could be quite amusing. The option to generate a link for other players to immediately join a game room would make the game setup process more convenient. It removes the extra step of navigating to the website and inputting the room code. Another design choice worth implementing that would increase convenience is to allow guests who lack a Card-IT account to join a game room. In this case the room host must have an account and only players with accounts can manage what decks would be used for the game.

There are some limitations that would be worth amending. One of them being that Card-IT only supports Italian. If other languages are implemented into the base system, Card-IT Versus would appeal to a greater audience. A clear choice for language expansion would be French as it belongs to the same language family as Italian (romance), sharing characteristics of having a complex verb morphology. This in turn would enable us to collect a wider variety of opinions on the game from those who have different language learning interests. Language learning topics other than verb conjugation would be interesting to explore and brainstorm their potential for gamification as well.

Another limitation that could be addressed is that Card-IT Versus can not be played alone. This can be addressed by providing the option to play against a computer player or a replay of a game that one previously had with real players. The computer player could be set to an easy, normal or hard mode. The computer would receive items and use items randomly throughout the game. Also in the more difficult modes the computer would answer questions faster and tend to obtain stronger items. If a solo player chooses to verse a replay of a past game, the only aspect of the game that would be replayed is how quickly the opponents answered the

questions. The item distribution and exchange would be performed like computer players on the normal difficulty.

The confusion of the status bar being understood as a racetrack may be worth removing. The design of the status bar could be simplified by removing the slider and its moving thumbs. It could be replaced by a horizontal list of each player's username, status and points. This would be like the current status bar but without the moving thumbs. The current status bar could be repurposed as an actual racetrack in a new game mode that could utilize it. For example, it would make sense if the range of the slider is based on a certain amount of points that must be gained to finish the game. In this case, players would have to work through spaced repetition of the flashcards until they reach the amount of points they need to finish the game. Their position on the racetrack would move relative to the amount of points they gained.

The multiplayer gameplay of Card-IT Versus focuses on a competitive experience. In order to add more gameplay variety and gain interest in players who are not as competitive, a co-operative multiplayer mode is another idea worth implementing. In the co-op mode players would go through a pool of flashcard questions together in either the "Conjugate" or "Identify Tense" quiz types. The pool of questions would be made up of a combination of decks that players would add to from their own collections. The main goal of this mode is to complete all questions together as fast as possible. Once a question from the pool is answered, the question is answered for all players and it will not appear again for anyone to attempt. The gimmick of this mode is that players can give each other hints and items. For example, if a player is stuck in the Conjugate quiz, they can call for help. Once another player chooses to help them, they would see the question that the player is stuck on and are able to type the next few letters of what they think the answer is. In terms of item distribution, all items would be assist items and only one player would be receiving them throughout the game. In order for other players to get items the player that receives all the drops would have to supply the others with them. This gives some responsibility and strategy to the player in charge of items. For example, it would be strategic to provide more items to the player who is struggling the most. Perhaps, this role could be switched once or twice during the game.

9 - Conclusion

In conclusion, this thesis discussed the need and importance of gamifying language learning. In order to advance the gamified aspect of digital language learning, we developed a competitive multiplayer game called Card-IT Versus. Card-IT Versus offers a novel way for students to learn Italian verb morphology. It is an extension of Card-IT, a language learning application with the goal of teaching Italian verb conjugations through flashcards. The games in Card-IT Versus are based on the "Conjugate" and "Identify Tense" quiz types from the base Card-IT system. The game is designed to engage students in what could otherwise be found as an unpleasant and tedious memorization process. The competitive aspect of Card-IT Versus would provide students with more motivation and purpose to study as they would have friends to directly compete with. During the game, players will try to correctly answer a series of flashcard questions based on the deck(s) of flashcards they organized for themselves from the base Card-IT system. In order to win the game, players must attain the most points by correctly answering questions as fast as possible. A variety of 14 items can be obtained during the game that have the ability to assist a player or stall one of their opponents. Items make Card-IT stand out from other gamified language learning apps by giving players a way to sabotage each other's games. Items also balance the game by providing poorly performing players with chances to catch up. Card-IT Versus required the development of a Socket.IO server and new React.JS components. For future work, Card-IT Versus should be evaluated to discover if it is an entertaining and productive method for learning Italian verb morphology.

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