Picard: A Creative and Social Online Flashcard Learning Game

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ABSTRACT

Many subjects such as languages, history, biology, geography, law, and medicine require the memorization of large numbers of unstructured facts and vocabulary. While there are many techniques and tools for memorizing such information, sustaining motivation remains a major barrier towards progress in these subjects. In order to help fill this gap, we brainstormed, experimented, and paper-prototyped to create Picard, a Facebook game that intertwines creative and social elements to turn rote learning into a creative, engaging experience. Picard, inspired by Pictionary, encourages players to come up with creative stories and images to help remember a particular card. Players compete and cooperate with their friends on Facebook to create the most memorable and funny mnemonics, called *Picards*, gaining points when they help themselves or others remember flashcards. Players use these Picards to learn and prove knowledge of the material at spaced intervals, which research has shown to be maximally effective for learning. Our game is the novel combination of an established learning methodology with player creativity and social support for learning. Picard increases player investment in the process of learning by allowing players to create and share useful visual mnemonics, while at the same time motivating and structuring their study habits through spaced-repetition quizzes.

Categories and Subject Descriptors

K.8.0 [**Personal Computing**]: General – Games; K.3.1 [**Computer Uses in Education**]: Collaborative Learning

1. INTRODUCTION

Amidst a tangled web of seemingly unrelated material, there are connections waiting to be drawn. These connections, put in the form of a sketch or phrase, can leap off the page and embed themselves in the viewer's brain. Memorizing a bulk of information in the absence of these connections
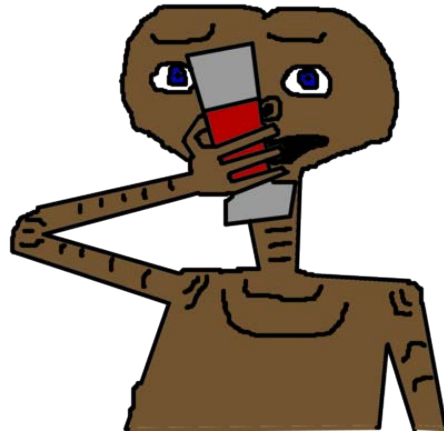
Figure 1: With the caption *The Extra-Terrestrial [Eritrea] has Asthma [Asmara]*, this mnemonic device (called a Picard) helps people remember that the capital of Eritrea is Asmara.

is hard enough, to say nothing of staying motivated while poring over an extensive amount all at once. To address these issues and more, we developed Picard.

The premise of our game Picard is that players studying a particular topic using flashcards, such as the capitals of countries around the world, draw amusing sketches like the one shown in Figure 1 (called *Picards*) to help them remember each card and share these mnemonics with their friends. Individual players do not have to invent a Picard for every single country because the creative effort is shared among the group, each player contributing to a global pool of mnemonics for that topic. But a player's in-game reputation is bolstered by creating a particularly clever (or absurd) Picard that helps other players remember that card. In addition to this creative and collaborative forum for learning flashcard content, Picard also offers players a structured way to review and test their knowledge through a process called spaced repetition. Spaced repetition is a technique in which players review the knowledge they have a weaker grasp on more frequently than the knowledge they know well. Players see a *mastery level* for each flashcard corresponding to how well they know each card and how often they will see it on
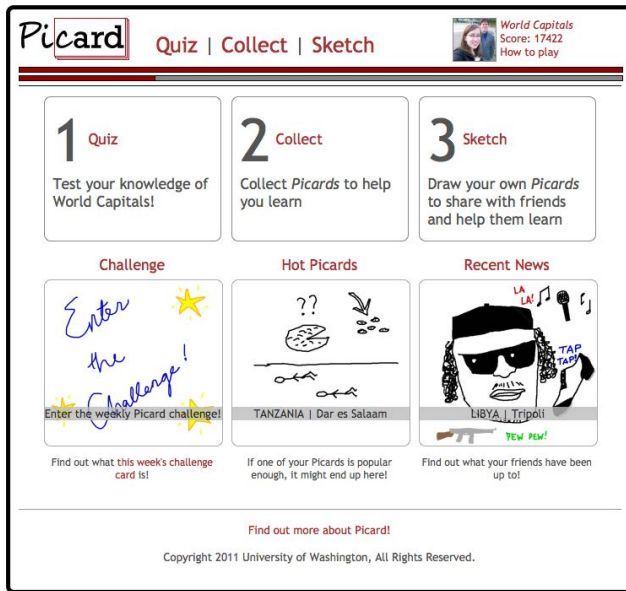
Figure 2: On the front page of Picard, the player sees several recent Picards, as well as quick links to the three main activities: quizzing, collecting, and sketching new Picards.

a quiz. Their goal is to achieve long-term mastery of all of their cards.

There are three components rarely seen together in other educational games that combine to make Picard fun and effective. The first component is a structured learning technique, in our case, spaced repetition. Next, we add a creative component in which players get a chance to express themselves but also reflect on their own learning processes. Finally, the Facebook-based social component is the glue linking one player's creativity to another's learning. Players share the creative effort, benefit from each others' teachings, and motivate each other to master their cards.

Picard is played on Facebook and we have incorporated many common features such as commenting and liking (in the sense of Facebook's "like" feature). Even liking a Picard and leaving an appreciative comment for the author is an action that can cement the material in the player's mind. Learning in online contexts has been shown to be more effective when students are encouraged to reflect on their own learning processes. A recent US Department of Education report [5] synthesized much of the existing literature about online learning and concluded, among other points, the following:

> Online learning can be enhanced by giving learners control of their interactions with media and prompting learner reflection. Studies indicate that manipulations that trigger learner activity or learner reflection and self-monitoring of understanding are effective when students pursue online learning as individuals.

Metacognition refers to thinking about thinking, which includes thinking about learning. Students who think about their own learning often improve their learning. For example, fostering metacognition has proven effective in teaching scientific inquiry, particularly with lower-performing students [6]. Picard's design promotes metacognition by enabling learners to create and evaluate learning devices. But to stop at pursuing online learning at the individual level is to miss out on a wealth of social interaction venues available online (which offer opportunities to think about others' learning in relation to one's own). Social platforms like Facebook provide opportunities for group learning. We believe that more educational games should embrace collaborative learning, particularly in a way that gives players creative freedom and opportunities to reflect, but also provides structure based on established educational methodologies and clear, achievable goals.

2. GAME DESCRIPTION

Now that we have introduced Picard, let us briefly review the terminology before delving deeper into the design of the game.

- **Flashcard**: A two-part concept with a *front* and a *back*. Not limited to text. For example, country and capital, word and definition, Kanji character and meaning.

- **Picard**: A picture and description that help a player remember the front, back, or both sides of a flashcard.

- **Topic**: A set of related flashcards. For example, the set of 196 countries and their capitals, GRE words, or foreign language vocabulary.

- **Partition**: A subset of a topic. Topics are broken into multiple partitions for easier digestion. Normally there are about ten cards per partition.

- **Player Library**: All of the cards that have been introduced to a player, and any Picards that player has collected for those cards. If a player only has access to two of ten partitions, only the cards in the first two partitions are in the player's library.

- **Mastery Stacks**: Stacks which represent different levels of mastery, based on how many consecutive times a player has correctly answered that card during a quiz, with increasing time delays between quizzes. These are exactly the stacks in Leitner's spaced-repetition system [4].

The core mechanic in Picard, and hence "Pic" in the name, is drawing mnemonic pictures or Picards to help remember flashcards. Because Picard is a social game, players do not make mnemonic devices to consume privately, but instead create useful, amusing sketches *for their friends* to see, appreciate, and learn from.

Picard tracks learning by quizzing players on the flashcards during the game. The quiz is based on spaced repetition, testing players more frequently on cards they do not know very well.

We now describe the different modes that make up the game, including the mnemonic browsing mode, the sketching mode and the quizzing mode. We follow the concrete example of a player studying country capitals. There are many different flashcard topics and anyone, especially teachers, can input their own sets of flashcards.
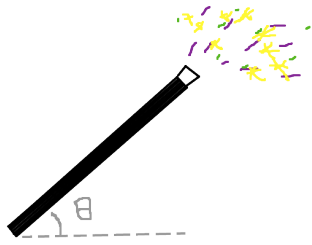
Figure 3: A user-created mnemonic device. This mnemonic helps players remember that the capital of Angola is the city Luanda. The caption for the mnemonic is: *AngL-U-WANDA (angle your wand-a!)*

Figure 4: When the player clicks the "Collect" link at the top of the page, she sees an overview of all the Picards she has collected for each of her flashcards. Flashcards without Picards show an option to collect a Picard, or if no Picards exist, to draw one. She can click on a thumbnail to see a larger view of each Picard, including the caption, artist, likes, and comments.

2.1 Collecting Mode

Player George wants to learn the capitals of all the countries and wants to do so by playing Picard. When he begins playing Picard, he knows very few capitals. The game introduces cards in small chunks of about ten cards, instead of overloading George with all 195 capitals, so George only has ten cards to master at first, and then twenty, and so on. He studies these first ten cards, trying to remember, for example, that the capital of Angola is Luanda. Luckily, another Picard player has drawn the Picard shown in Figure 3 and captioned it, 'AngL-U-WANDA (angle your wand-a!)'. George thinks this is a great device and *collects* it so that whenever he studies the Angola/Luanda card, he sees the angled wand mnemonic. To learn his other cards, George looks through the multiple Picards other players have drawn. Even if George decides not to collect a device, he can leave a comment or like it. Figure 4 shows the device choices a player has for a particular card. When George gets a clever idea for a particular card, perhaps a card that no one has

yet drawn a mnemonic for, he goes to sketch that card.

2.2 Sketching Mode

Figure 5: The Sketching tool for creating new mnemonics. The interface includes standard drawing tools such as colored pens, a line tool, a fill tool, and an eraser.

When our player George thinks of a brilliant mnemonic to draw for card Bahrain/Manama, he clicks "Sketch this card!" and is taken to the Flash-based sketching interface. In the web browser where Picard is played, George uses the mouse to draw out his idea. He has a number of tools at his disposal, including different colors of a virtual pen, a fill tool, an eraser, and undo/redo buttons. Figure 5 shows George using the sketching interface. When he is satisfied, George clicks "save" and enters a short text description for his card: *"Baaaah-RAIN = little wet sheep wants its Ma[na]maaaa!"* The device he just created is automatically set as his study aide for that card.
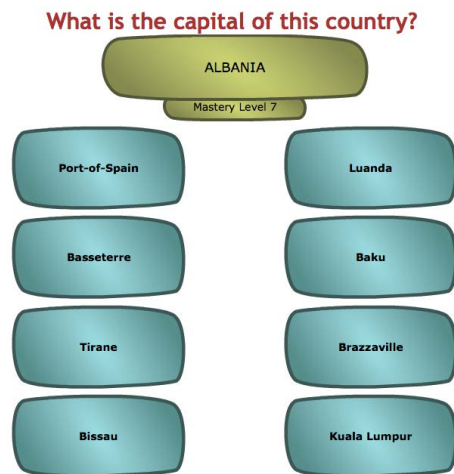
2.3 Quizzing Mode

Figure 6: The quiz showing the country, Chile, and eight options for the capital. (The capital of Chile is Santiago.) Behind the quiz, players can see how cards move between stacks.

To determine if George is learning the capitals, he needs to be quizzed on them occasionally. The quiz is a multiple-choice quiz where the front side of a card is shown, in this case the name of the country, and the player picks the correct capital from eight options, as shown in Figure 6. Rather than quiz George on cards randomly, Picard uses spaced repetition to quiz George on cards that he doesn't know very well before his well known cards.

What George sees on his home page and going into the quiz is several stacks of cards, each corresponding to a different level of mastery. To begin with, all his cards are at mastery level 0. Every time George answers a card correctly, it moves to the next level. If he ever gets it wrong, that card moves back to level 0, the unmastered cards. Additionally, each level has a time duration associated with it. For example, the first level has no timer because it only contains unmastered cards, but the second stack has a duration of one day. Any card from mastery level 0 that a player answers correctly becomes mastery level 1 and will not be a quiz question until 24 hours have elapsed, which means that George has to remember that card for at least an entire day, and if he forgets, it will move to level 0 again. To boost a card into the upper levels, George must have repeatedly gotten its quiz question correct over the course of many days, with increasing time delays between each quiz.

As George gets better, he acquires more cards. When he masters his current set of flashcards for at least the minimum stack time, he unlocks a new partition and can add a new set of ten new cards to his collection. By the time George has reached level ten, he has about 100 cards that he is trying to learn. These cards each have their own mastery level according to how well George knows them on the quiz.

3. EVALUATION STRATEGIES

We would like to show that Picard is a fun and effective environment for learning flashcards, one that keeps players entertained and motivated and aides in long-term retention. To this end, we are anonymously logging the activities of each Picard player, including quiz results and which Picards a player had collected at the time of each quiz. As we collect more data over the longer term, we should be able to trace the learning curves of our players and identify when and where particular Picards had an impact.

We have begun to analyze the effectiveness of Picards using Statistical Relational Learning [2]. Using Alchemy[1] on a subset of our data, we have seen that players who collect Picards are more likely to get quiz questions correct. We have also been able to identify some of the most and least helpful Picards. With more data, we would be able to present a formal report.

We are also interested in the possibility that showing players the learning effects of *their own* Picards on *other* players will shape how they play the game and how they design Picards. If a player draws an especially memorable Picard and the game recognizes him for that, perhaps he will be motivated to create more Picards based on what is most successful about his earlier Picards.

4. RESEARCH CONTEXT

We are interested in exploring the potentially overlapping effects of spaced repetition, player-created mnemonics,

and social gameplay. There are already a number learning tools based around spaced repetition, including Anki [3], Mnemosyne [1], and SuperMemo [7] and a few of these tools even support mnemonics. The mnemonics are generally distributed with the flashcard deck, however, not invented by the user, nor invented within a social context, which might make the mnemonics more meaningful. In addition to examining the combined effects of spaced repetition, player-created mnemonics, and a social context for learning, we are also forging new ground in which players produce *externally* valuable content. That is, the mnemonics produced by Picard players have value on their own and could help others to memorize the same topics without actually playing Picard.

5. TECHNICAL REQUIREMENTS

Picard is available on Facebook at `http://apps.facebook.com/picardgame`. All that is required is a Facebook account and granting permission to the application. We have anonymized players' identities in our database, and if you are not Facebook friends with other Picard players, you will see Picards drawn by "Player #1234" and so on. If you play Picard with friends, you will be able to see their names when you are logged into the game.

6. CONCLUSION

We have presented Picard, a Facebook game for studying flashcards. Picard is the novel combination of the learning theory of spaced repetition, creative input by players with their own mnemonic devices, and a social environment for players to communicate and help each other learn and stay motivated.

Both developing and playing Picard has been an immensely enjoyable experience for the authors. We invite the reader to join us on Facebook: `http://apps.facebook.com/picardgame`

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