Gamified Tool for Aiding Natural Acquisition of the Japanese Writing System

Firas Mohamed Altayeb, Tokyo Institute of Technology

Abstract: This research aims to investigate whether a learning paradigm introduced by the book *The Natural Approach* can be used to teach second language learners of the Japanese language the meanings of kanji and, more importantly, how to efficiently and naturally acquire vocabulary and all possible readings for said kanji.

Keyword: Kanji learning, Gamification, Spaced Repetition, Natural Approach

1. Research Goal

This research aims to investigate whether the natural acquisition approach can be used to teach second language learners of the Japanese language the meanings of kanji and, more importantly, how to efficiently and naturally acquire vocabulary and all possible readings for said kanji. To achieve this, I aim to combine, build, and improve on existing effective methodology and incorporate a learning paradigm introduced by the book *The Natural Approach* (Stephen et al., 1983).

2. Approach

It can be said that solutions to learning the Japanese writing system already exist, such as the book series, *Remembering the Kanji* (James W. Heisig. 2011), and spaced repetition software tools. However, said solutions require the learner to have a high level of tolerance and motivation to use for an extended period. Moreover, said solutions have well-known resolvable issues and a significant improvement potential when coupled with methodology brought forward by the book, *The Natural Approach* (Stephen et al., 1983). Hence, this research approach involves creating a tool that will first use an improved version of *Remembering the Kanji* to teach learners the fundamentals of the Japanese writing system, e.g. a meaning for each kanji. Next, and while learners are learning more kanji, the tool will use an enhanced spaced repetition algorithm and *The Natural Approach* methodology to reinforce learned material and potentially assist learners in acquiring more information such as kanji readings, secondary meanings, vocabulary and frequent grammar structures without significant effort.

3. Methodology

The Natural Approach (Stephen et al., 1983) is a well-known book by professor Stephen Krashen of the University of Southern California that introduces the input hypothesis and methods to implement it. The input hypothesis suggests that having learned the basics of a language, any

student can go on to master the language by frequently getting exposed to comprehensible natural input from the target language. In the approximately 40 years since the release of the book, many studies and experiments have been released that validated most of its claims. That being said, most of the studies were done using Indo-European (Johanna F. de Vos, Herbert Schriefers, Louis ten Bosch & Kristin Lemhöfer. 2019) languages and hence this research aims to examine whether the same methodology can be used to teach second language learners the Japanese writing system.

3.1 *Remembering the Kanji* (RTK)

In order to fulfil the first and most important condition of the input hypothesis - obtain knowledge for basic language comprehension - this research aims to use the first book of the *Remembering the Kanji* (James W. Heisig. 2011) series, which uses a unique methodology to teach the most common meaning for each Jouyou Kanji. Heisig, who authored the RTK book series, suggested associating each kanji and its primitive elements with a keyword and then connecting them using mnemonic devices. RTK was considered radical when it was first released as it introduced the concept of primitives and an order for presenting kanji that prioritizes building blocks over frequency. Primitive elements are regularly occurring fundamental strokes that appear in kanji, e.g. the top half of the kanji 今 that appear in 会合令 and the top half of the kanji 左 that appear in 右有. Primitive elements can be combined with lexical radicals and other kanji to create more complex kanji. The only difference between lexical radicals and primitive elements is that the latter does not have a Unicode and is not recognised by most Japanese dictionaries. As primitives, radicals and most simple kanji can create other kanji; they are all considered building blocks. RTK first presented simple kanji, primitives and radicals before presenting complex kanji so that learners can recognise the parts making up the kanji and quickly learn them using mnemonic devices. Mnemonics devices are stories or sentences that aid students to encode and effectively remember information, e.g. if the learner is trying to remember cat, leaf and wind in this exact order, an example mnemonic would be "A pink cat is chasing a giant leaf blowing in the wind".

3.2 Modified *Remembering the Kanji*

RTK, released in 1977, is still primarily used and loved by learners worldwide. Many people who mastered Japanese credit their achievement to it. However, Heisig's methodology has several problems that are felt even by most staunch followers. First of all, the approach can mistakenly be perceived as only teaching the 'alphabets' of Japanese to those unfamiliar with it. Secondly, most students give up due to not noticing any immediate results, which primarily stems from not being taught how to read kanji straight away. And finally, also most notably, the method requires a lot of continuous motivation and a high ambiguity tolerance threshold. These problems can be alleviated

or solved using filtration, reordering, gamification, and, most importantly, mass immersion which is an integral part of *The Natural Approach* (Stephen et al., 1983) methodology. Due to Heisig's tendency of showing all possible kanji combinations that introduced primitives can build, a considerable number of kanji characters in RTK are not Jouyou kanji, such as 汐 which appear in frame 110, page 61. Moreover, several kanji introduced early in the book appear very infrequently in raw text, such as 婿, which appears in frame 395 out of the 2024 available frames. To increase the learner's odds of finding learned kanji in Japanese material they would like to consume, an improved RTK order will be implemented in the tool. In addition, all non-Jouyou kanji will be filtered out as they add little value to all but advanced students, and all infrequent kanji that appear in the beginning part of the list will be moved down. Doing so will also decrease the kanji ambiguity tolerance needed to consume material written in Japanese and result in higher motivation to learn even more kanji. Using mostly frequent kanji will also make mass immersion more practical.
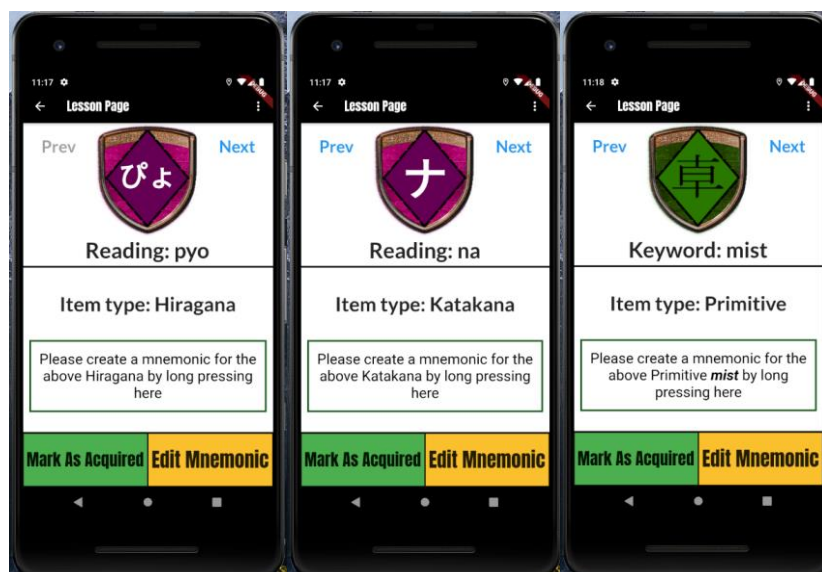
3.3 Learning Tool Gamification

Figure 1: Hiragana, Katakana and Primitive Badges

A study (De Freitas, M. 2013) done by the US Air Force Academy on undergraduate level Computer Science students showed that by transforming a traditional classroom experience into a competitive multiplayer game, motivation among students remarkably rose. In the hope of replicating the same results, the developed tool incorporates gamification by presenting kanji as badges and tasking learners to collect them. The badges differ in shape and colour based on whether they are kana, primitives, radicals or whole kanji. Users are also given scores for their learning sessions and badges for consecutive daily usage.
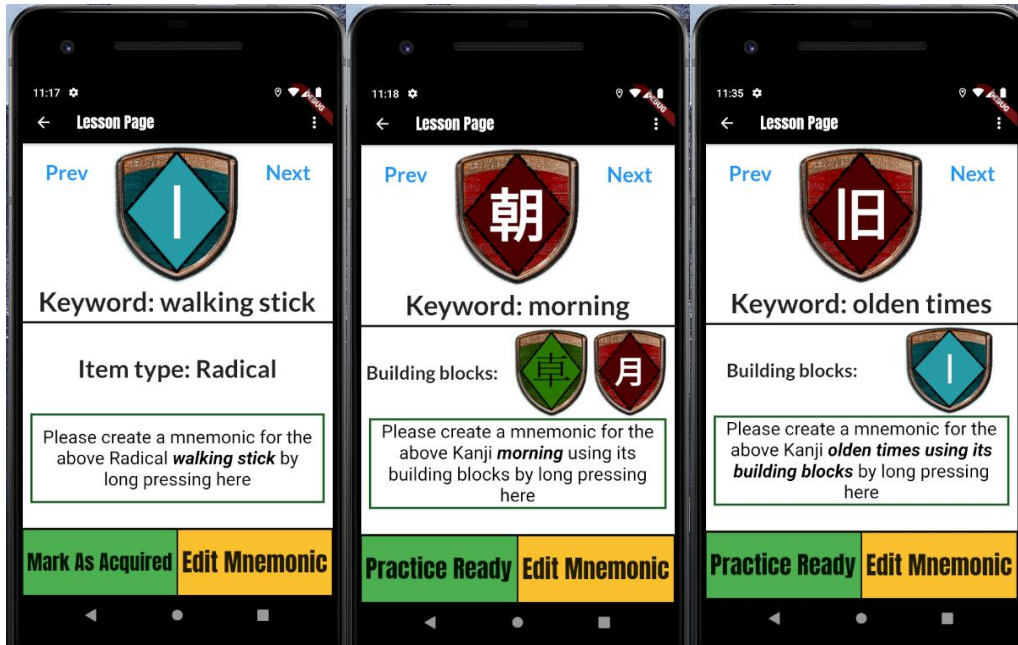
Figure 2: Kanji and Radical Badges

3.4 Mass Immersion Implementation

To incorporate mass immersion in our tool, a special sentence retrieval algorithm was implemented. The algorithm works by using a file (generated beforehand) containing over 5 million sentences from over 10,000 Aozora Bunko novels. To increase the chances of presenting the users with comprehensible input, sentences that contain non-Jouyou kanji or infrequent kanji were filtered out. What makes this algorithm special is how it only retrieves sentences for users that contain only kanji that the user has already learned hence ensuring they are always comprehensible - to a varying degree. To ensure users periodically immerse in Japanese sentences, a modified spaced repetition algorithm was implemented into the tool.

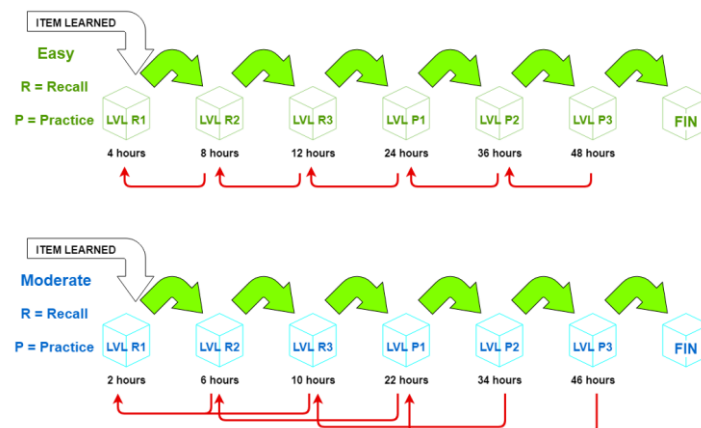## 3.5 Enhanced Spaced Repetition Algorithm

Figure 3: Improved Spaced Repetition Algorithm – easy and moderate

The spaced repetition algorithm is a learning technique that incorporates increasing intervals of time between subsequent review of previously learned material to exploit a psychological effect that helps retain items in memory. A study (Bower, V., Rutson-Griffiths, A. 2016) done on Japanese language students over ten months found a strong relationship between extended studying using spaced repetition software (SRS) and test score gains. The study showed that out of the 72 participants, 60 participants who continued using an SRS acquired an overall 11% score increase compared to their pre-SRS test scores. The 12 participants who did not continue using the software stated lack of motivation as the cause. That being said, due to the inclusion of gamification, fewer students are expected to stop using the SRS. Usually, there are five stages, and after reviewing an item for the fifth time successfully, the item is considered learned. When an item is forgotten or answered incorrectly, it is said to have lapsed. The algorithm's default behaviour resets all lapsed items to stage one, i.e. the user will have to recall the forgotten item again several times consecutively for it to be considered learned. However, not all kanji have the same difficulty, so a varying new interval (stage level) should be considered for every kanji. To impartially determine each kanji difficulty, the spaced repetition algorithm was modified to include a dynamic difficulty selector.
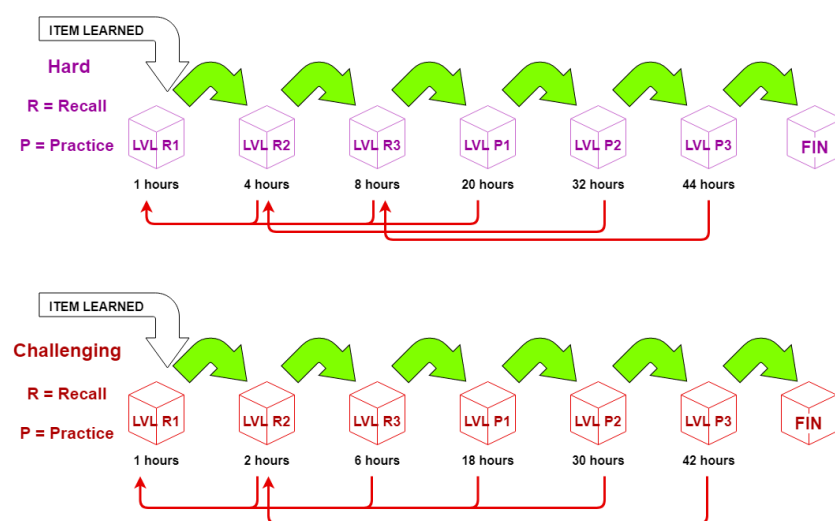

Figure 4: Improved Spaced Repetition Algorithm – hard and challenging

The more difficult the kanji is, the more stages the user will have to redo when the item is recalled incorrectly. In addition, the more difficult the kanji is, the smaller the interval becomes between subsequent reviews. Smaller intervals were considered so as to allow users to review difficult items before they are forgotten. Furthermore, the other unique aspect of the modified spaced repetition algorithm is that depending on the stage, the user would either be asked to simply recall the kanji or go over a presented sentence that uses the same kanji.

5

References

James W. Heisig. 2011. *Remembering the Kanji Vol. I*, Fourth Edition. Japan Publications Trading Co., Ltd.

Stephen D. Krashen and Tracy D. Terrell. 1983. *The Natural Approach*: Language acquisition in the classroom. Hayward, California: The Alemany Press.

Johanna F. de Vos, Herbert Schriefers, Louis ten Bosch & Kristin Lemhöfer. 2019 Interactive L2 vocabulary acquisition in a lab-based immersion setting, Language, Cognition and Neuroscience, 34:7, 916-935, DOI: 10.1080/23273798.2019.1599127.

Bower, V., Rutson-Griffiths, A. 2016. The relationship between the use of spaced repetition software with a TOEIC word list and TOEIC score gains. *Computer Assisted Language Learning,* vol. 29, pp. 1238–1248.

De Freitas, A., de Freitas, M. 2013. Classroom Live: A software-assisted gamification tool. *Computer Science Education,* vol. 23, pp. 186–206.