The LV Approach, a Revolutionary Approach to the Study of Kanji: First use of the Learner's Visual Cognition in a Kanji-Learning Support System

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Although there are plenty of studies about learning kanji, there are few if any that elucidate the key role and effect of the learners' personal visual cognitive processing in the learning process, specifically in the cognitive process that learners experience when guided to mentally divide the shapes of individual kanji into distinct parts as they view them. (We refer to these parts as the "visuospatial-temporal blocks", individually updatable visuospatial cognitive non-overlapping units). This study focuses on the question of whether or not guiding learners with a kanji-learning system that makes use of their personal visual cognition based on a suitably preestablished set of possible deconstructions (ways to divide a kanji into blocks) produces a significant effect on learner's recall of kanji's shapes and meanings. First, a novel approach to kanji-learning called "Learner's Visualization (LV) Approach" was conceived and formally proposed; the LV Approach includes a learner-guided technique that presents the user with a set of layouts representing how an individual kanji could be logically divided into blocks, allows the user to choose which layout he or she prefers (which layout currently appears the most logical or understandable to that user), and then guides the user in further exploration and learning about blocks within his or her chosen layout. This paper evaluates the merit of this novel approach for learners who are not accustomed to using a writing system similar to kanji, focusing specifically on the implications of taking into account learners' personal visual cognitive processing. The implementation of a learning support system based on the LV Approach and the positive experimental results of the proposed approach are discussed.

Key words : kanji, kanji-learning approach, visual cognition, components, block, deconstruction, learning supporting system, kanji-learning system

1. INTRODUCTION

1.1. A Novel Approach

The core of the present paper is to propose a novel approach for a kanji-learning system, specifically an approach for foreign learners who have no background in kanji. Consequently, a system to evaluate the effect of this new approach was developed. The implementation was done with the specific purpose of evaluating whether or not there is a significant benefit in taking into account the personal visual cognition of kanji learners during their process of absorbing kanji's shapes and meanings. The system’s software allows learners to choose from a predefined set of ways in which each featured kanji can be visually "deconstructed" into "blocks" (non-overlapping groups of strokes within the kanji). To illustrate the concept of a block, the kanji 嬉 'glad, happy' could be deconstructed (divided), among other options, into the set of blocks: “女,喜”, or into blocks: “女,十,豆,口”, note in the latter set the block 喜 was further divided into “十”, “豆” and “口”, creating 3 smaller blocks. As another example, the kanji 驚 ‘surprise’ could be deconstructed into: “犬,馬”, or into “蛇,虫,馬” among other possible sets. As a negative example we have 東 separated in “木 and 日”, or “田 and 木”. We have chosen to call this approach, which is based on the individual learner’s visual cognitive processing, the Learner’s Visualization
(LV) Approach.

A distinct advantage of the LV Approach is that learners begin with the deconstruction layout of their choice. Each learner is a unique individual (Wertsch 1997) and individual learners may have different ways of visually deconstructing the same kanji. With the LV Approach, the learner chooses the deconstruction that most closely represents how he or she would naturally visually divide the kanji into blocks. No learner is forced to follow predefined kanji deconstructions such as those that appear in existing kanji–learning materials (although the author’s intent here is not to disparage current approaches to the study of kanji). Another advantage of this new approach is that even completely novice learners can visually interact with kanji; the LV Approach allows each learner to explore the possibilities of how a kanji could be divided into blocks, even if he or she does not yet attach any linguistic meaning to those blocks. This facilitates learners’ assimilation of kanji, which can appear very “foreign” and indecipherable to a beginning student (Inostroza et al. 2008). This unique aspect of the approach may play a role in kanji students’ motivation and confidence to continue in their studies, although this point was not evaluated in this study. In concrete words, the proposed approach is based on a synergetic technique of analysis and synthesis, which makes the activity of studying kanji with the LV Approach more than a process of pure rote memorization.

The experimental results, which were better than expected, are discussed and the main contributions of the study are summarized.

1.2. Motivation

Considering that the kanji writing system uses highly complex visual characters compared to those of the western alphabet, our initial assumption is that these complex kanji could be visually divided in different ways by different learners, especially when they face with this particular writing system for the first time. So far, various kanji–learning systems have been developed but the way in which a beginning student perceives individual kanji has not yet been taken into account. The aim of this work is to enhance our understanding of the kanji learning process and to exploit it, in the near future, in personalized kanji–learning systems. There is as yet no approach that considers the learner’s personal visual cognition in its design. This work is a step towards developing one through the Learner’s Visualization (LV) Approach; our aim is to provide new insight into how future learning support systems can best help kanji learners.

How should learners be taught to synthesize (combine) smaller/simpler blocks into larger/more complex blocks? Would it be useful to first consider the way in which the learner would personally choose to divide that kanji into distinct blocks even if he or she does not yet attach any meaning to those blocks? If so, what is the best way to design a system that will work with the learner at his or her current personal visual cognition? These are the main questions in this work. There are no universal answers, but the aim is to open new doors in the field of kanji–learning educational tools.

1.3. Statement of the problem

If the learner’s personal way of dividing a kanji into its blocks is an important element to include in the development of kanji–learning systems, how could we begin to incorporate this? First of all, we must find out how useful this element would be. It is not straightforward, however, to implement in a computer system a comprehensive set of rules for dividing a kanji into its parts due to the inherent complexity and all the subtleties of the structure of kanji. It should however be possible to evaluate first if the supposed benefits exist.

Our work is focused on the following question: “Is there a benefit to incorporating suitably predefined deconstructions of kanji (not necessarily including every possible deconstruction, but the ones most suitable for guiding learners) into kanji–learning systems?” “Can learners, via kanji–learning systems, be guided to analyze and synthesize kanji using their visual cognition while choosing from predefined deconstructions of kanji?” If so, can this improve their recall of kanji’s meanings and shapes?”

We believe it may well be rewarding to look into new strategies for future kanji–learning educational systems that better suit learners’ personal cognition. Here, our first effort is to provide learners the control and flexibility to divide kanji in the way that most closely matches their personal visual cognition in contrast to how kanji are divided for the student in a prescribed fashion in conventional learning material.
2. PRESENT STATE OF KANJI LEARNING APPROACHES AND KANJI LEARNING SYSTEMS

2.1. Kanji-Learning Approaches

Teaching the kanji writing system has hitherto been focused on the following approaches:

2.1.1. Radical Approach

This method uses “radicals” (in Japanese, 部首 bushu) as the key elements of any kanji, grouping kanji according to radicals present within the characters. Limitations of this approach lie in the heterogeneity of the different groupings and in the fact that there are variations on the radicals’ shapes. Different dictionaries also identify different numbers of radicals, which leads to difficulties in learning even daily-use kanji (常用漢字). For example, Hadamitzky (2003) in his handbook and dictionary uses a list of 79 radical (with variants), while Labus (2000) uses the traditional list of 214 radicals in his Japanese–Czech dictionary. While Labus presents the kanji 免 with radical 关, the kanji 象 with radical 氵, and the kanji 劭 with radical 力, Hadamitzky presents all those kanji within a “radical” whose representation is the same like taking out the shape 厄 from the shape 厄.

2.1.2. Frequency-Based Approach

This approach is based on Monbusho’s Educational Kanji Chart (教育漢字の学年別漢字配当表). The main drawback of this approach is the fact that some kanji are taught without taking into account their visual components. For example, “eat” (た-beru, する/SOKU) is taught in the second grade, but its component, “good” (よ-i, RYOU) is taught in the fourth grade. Teaching a kanji without previously teaching its elementary components is common but may not be efficient for foreigners.

2.1.3. Component Approach

In this approach all the parts of a kanji are identified as components. A component is a set of strokes which virtually keeps the same visual shape. For example, 歌 is composed of the components: 矢 and 口; another example, 東: “木 and 日” or “日 and 木”. Components are associated with a pattern, which defines the relative position of them. The main advantage of the component approach is that it emphasizes learning the semantic/phonetic building units of kanji. These subcharacter units have been named in different ways: Heisig calls these basic units “primitives”, Foerster and Tamura call them “graphemes”, and Scott Alprin calls them “elements” (Noguchi 2002). What differs from these “components” (and all the aforementioned terms) to what we refer to and coin in this paper as “visuospatial-temporal blocks” is that these “blocks” are individually adaptable over time and visuospatial cognitive non-overlapping units.

2.2. Kanji-Learning Systems

Although there are plenty of works that have researched kanji, as for kanji-learning systems, all existing works are based on the above described approaches. Nonetheless, it is worth mentioning that a kanji-learning CAI system called “Kanji Laboratory” (Yano 1996) allows learners to construct kanji by combining kanji’s parts, although it focuses on the learner’s understanding of the part structure of kanji, i.e., an analytical approach (as have all kanji-learning systems up to this point) and does not utilize a synthetic approach. The Kanjinr (Hayashi 1993) system, which is also based on the partial structures of kanji, pays attention to the inherited attributes (meaning and pronunciation) that influence kanji. As for related commercial systems, Kanji Sensei is an interactive kanji study aid program that adds the visual aid of colours to the kanji parts.

Regarding potential exploration in kanji research, Mori (2007) reported that students’ task-specific beliefs have a significant impact on their achievement in a given task, and also remarked on the importance of developing kanji-teaching methods based on the shapes of kanji.

3. LEARNER’S VISUALIZATION (LV) APPROACH

We have designed a novel approach to learning kanji that we call the Learner’s Visualization (LV) Approach. The LV Approach is based on the concept that when learners view a kanji, they already have a tendency to mentally divide or “deconstruct” that kanji into groups of strokes, or some learners will deconstruct the same kanji in different ways. Thus, rather than directing students to visualize particular components within a kanji (as with the Component Approach), we believe a more effective approach would be to create a system that allows learners to choose their preferred way of dividing a kanji and then guides their study based on that choice. We believe the LV Approach will feel much more natural and logical to the student than any kanji learning approach that has come before, thus creating a
more positive and successful learning experience.

The LV approach involves three elements: 1. the learner’s visual cognition, 2. multiform deconstruction of kanji, and 3. block analysis/synthesis. The first element, the learner’s visual cognition, is the way in which every learner visually divides a given kanji into "blocks" (visuospatial-temporal blocks). The second element, multiform deconstruction, is the set of predefined possible options of how kanji could be broken down into blocks, from the highest number of small (and relatively simple) blocks down to just one complex block (which in this case is the whole kanji itself as a single unit). The third element is the analysis/synthesis cognitive strategy embedded in the LV approach which allows the user to analyze the given kanji by selecting any block inside it for further study, or to synthesize that block with a bordering block inside the same kanji, suggesting a larger block to be considered that combines the two smaller ones. This illustrates how the LV Approach is different from the Component Approach, which focuses on analysis only (which explains why it is also called the Analytical Approach). Table 1 summarizes the differences between the conventional approaches discussed here and the LV Approach. Besides, the three elements are fused in a technique capable of enhancing the retention of kanji’s shapes and meanings. With the LV Approach, learners can use their own personal visual cognition (1), and the multiform deconstructions (2), to choose which deconstruction layout works the best for them in visually analyzing, understanding, recognizing, studying, or simply viewing that particular kanji, after which learners are guided in analyzing and synthesizing the different possible blocks of that kanji as appropriate for their specific visual cognitive processing style (3). This technique is further explained in Section 4.

Figure 1 shows that with the LV Approach, in contrast to other approaches, learners choose which way to deconstruct a kanji, therefore each learner can concentrate on the complexity level of blocks that they themselves feel most comfortable with. We believe that this strategy helps learners gain competency with kanji, based on the idea that if learners heighten their situational awareness of building visuospatial-temporal blocks within individual kanji, progressing from seeing simpler blocks to seeing more complex ones at their own pace of kanji visualization development, they certainly will acquire the ability to better analyze/synthesize complex kanji based on their understanding of simple kanji and simple blocks present within studied kanji.

Figure 2 shows an example of how a learner visually divides/deconstructs a given kanji into blocks, and then chooses which deconstruction works the best for her according to her own visual cognition.

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Fig. 1. Different learners, different breakdowns with. We believe that this strategy helps learners gain competency with kanji, based on the idea that if learners heighten their situational awareness of building visuospatial-temporal blocks within individual kanji, progressing from seeing simpler blocks to seeing more complex ones at their own pace of kanji visualization development, they certainly will acquire the ability to better analyze/synthesize complex kanji based on their understanding of simple kanji and simple blocks present within studied kanji.

4. DEVELOPMENT OF THE LEARNER’S VISUALIZATION (LV) SYSTEM

Through an exhaustive analysis of kanji–learning tools, including research prototypes as well as commercial systems, we have found none that are guided via the learner’s visual cognition; consequently, it was necessary to develop a new system for pursuing our research.
4.1. Design of an Integrated Technique

The technique that integrates the three elements of the LV Approach is detailed in Fig. 3. The functionality of the modules analysis and synthesis appear highlighted in green to represent the analysis, and in red to represent the synthesis.

The interface of the kanji-learning support system we have created, the Learner’s Visualization (LV) System, integrates and manages the data flows of the analysis and synthesis modules while the user operates learning activities. The update module allows learners to select new ways of deconstructing all of the examined kanji. The learning algorithm is specified, mentioning the actions that take place, along with the respective connection to the database.

4.2. The Learning Environment

The learning environment of the LV System has the following features:

- Learners can select any predefined way of deconstructing a given kanji into blocks.
- Learners can then examine and learn about any block within their chosen deconstruction.
- Learners can also follow the suggestions of the system to assemble new larger and more complex blocks, creating what we call “superblocks” through a process of synthesis.

The learning environment of the LV System consists of a display of a set of predefined possible kanji deconstructions, and a group of boxes:

a. “Kanji Shape” box. A box displaying the kanji.
b. “Block Exploration Field” box. In this area learners can click on the corresponding location of a certain block of the given kanji that they want to examine further. The selection of a particular block is facilitated by the presence of the given kanji displayed in “Kanji Shape” box.
c. “Kanji Meaning” box. A box providing the meaning of the given kanji.
d. “Selected Block Info” box. A box providing information on the block selected in the “Block Exploration Field”.
e. “Synthesis of New Block” box. A box suggesting new, more complex blocks (“superblocks”) which are based on the combination of the block selected by the learner with another block which is adjacent to it in the given kanji. In this box learners can find examples of kanji that include the new superblock suggested by the system, and explore these examples if they choose.
f. “Analyzed Block Examples” box. A box showing other kanji which include the specific block that has been selected by the learner in the “Exploring Component Field” box.
g. “Recently Explored Kanji” box. A box showing the kanji that have been recently explored by the user. In this box a larger font size indicates a more recently viewed kanji. For example, in Fig. 4, the kanji 育 was viewed before 驚.

Learners can also opt to use a random function to generate a new kanji to study. This option appears in the link option called “Choose Another Kanji at Random” which appears below the “Recently Explored Kanji” box.

Fig. 4 illustrates the mentioned boxes of the learning environment, and the learning process sequence, explained as follows:

- The system shows a certain kanji with its corresponding meaning, for example, the kanji for “to be surprised, to be astonished”=“odoroku” (驚). Below the kanji, the system shows a set of predefined possible deconstructions in blocks into which the kanji can be divided. The users select the deconstruction that best matches the way they would naturally divide that kanji according to their own personal visual cognition. After selecting their deconstruction of choice, the system allows the users to examine and learn more by clicking on the zone of particular blocks within their chosen deconstruction as well as blocks within all the other possible deconstructions. When users click on the zone of a block, the system gives relevant information about it.
- The system then suggests that the learner consider a new, larger and more complex block which is constructed based on the block selected by the learner combined with an additional block also present in the same kanji, bordering the selected block. The new assembled block becomes a “superblock” in the kanji in study.
Further, Fig. 4 also shows the innovative analysis/synthesis technique of our system, explained as follows:

While the user is working on the kanji 騁 and examining the block 旅, the system suggests the construction of a new block "攵", combining (扌) with adjacent block 旅, and shows some examples of other kanji that include this newly assembled, more complex superblock. Learners can explore any of the examples just by clicking on one of them. The core of the technique lies with the recommendation of a "next complex block". For example, if the learner selected the block 旅, the "next complex block" suggested by the system is "扌+旅" = "攵". Alternatively, at the bottom of the learning environment users can choose to explore other kanji that include the block they selected.

5. EVALUATION

Two experiments of pre-test/post-test design (parallel group) were conducted to evaluate the LV Approach and its multiform deconstruction technique. The effectiveness of the method was measured by: a. the acquired skill to correctly recall the meanings and shapes of certain kanji b. the progression of visualizing kanji in fewer, more complex blocks blocks. Although the student should ultimately learn both how to read and write kanji, for the purposes of this evaluation, we focused solely on reading skill, specifically skill in recognizing meaning and shapes of kanji. The LV System does not attempt to address writing skills, not to mention proper stroke order.

5.1. Evaluation Method

During the conduction of both experiments learners were randomly assigned to one of two variants: the Control Group (G1), which used kanji-learning software with only one possible deconstruction layout for each kanji studied, and the Treatment Group (G2), which used the same software but with the option for the learner to select his/her deconstruction layout of preference from a set of predefined possibilities.

5.2. Participants

The participants in this study were 48 university students. The group included people of 19 different nationalities. All participants had little formal training in kanji and were from regions that do not use a writing system similar to kanji. Most participants reported that they had studied some Japanese either formally or informally. Participants reported the length of their formal Japanese study in semesters. All were beginners. The mean length of formal study was 3.23 months and the standard deviation, SD, was 1.17 months. Although most participants had a conversational familiarity with Japanese, all the participants had little, if any, formal study of the kanji writing system.

5.3. Instructional Material

A pool of 100 kanji were chosen including a wide variety of kanji with the intention that no two kanji's meanings should be the same or very similar.

5.4. Design

The description of our experiments is as follows:

- Type of experiment: Research Experiment, pre-test/post-test Control Group Design. True Experimental Design.
- Dependent variable: For experiment one, "retention of meaning" (of the shape of a given kanji). For experiment two, "kanji deconstruction level" scored via the mean number of blocks into which the user chooses to deconstruct given kanji.
- Independent variable: The presence or absence of multiform deconstruction treatment with the learner-guided deconstruction technique which is the characteristic feature of the LV Approach.
- Design: Subjects are randomly assigned to treatment so that equal numbers are in the control group and the experimental group.
- Goal: Compare post state and pre state to analyze the difference between the two groups.
- Question to answer: For experiment one, "Between both groups is there a statistically significant difference in the mean of retention of kanji meanings?". For experiment two, "Between both groups is there a statistically significant
difference in the mean of the level at which learners personally visually deconstruct kanji (mean number of blocks per kanji)?"

In both experiments, a paper-based kanji test was given to all the participants at the beginning of the experiment, which was the pre-test. Then, all participants were given a web-based version of the LV System to use; each group had the same pool of kanji within the system. Via the system, both groups were given the "Meaning of the Kanji" glossary, which consisted of translations. The pronunciation of the kanji was not given in the "kanji meaning" box.

For each kanji, all the participants were able to see the "kanji meaning" box as soon as the kanji appeared. However, only the participants of Group 2, which used the "learner-guided deconstruction treatment" version of the LV System were able to get the "synthesis of new block" box by clicking on any of the blocks within a given kanji. After using the system, a post-test was given to the participants; the post-test was the same as the pre-test.

Group 1 consisted of 24 beginners, and Group 2 consisted of 24 beginners.

5.5. Instruments
For experiment 1, a vocabulary test was conducted as a pre- and post-test. For each kanji word, the test asked the participant to write the meaning of the kanji only when he or she was totally sure of the answer. These instructions implied that participants needed to consider how well they actually knew the kanji so that our results would reflect only truly assimilated knowledge of the kanji as opposed to vague knowledge of the kanji. This criterion was included in order to correctly measure only the appropriate depth of kanji vocabulary knowledge as defined by Paribakht and Wesche (1993).

The test was designed to measure the dependent variable, retention of meaning, as mentioned above. Kanji Meaning Score (maximum score: 100) represents the number of the tested kanji for which participants were able to give the correct meaning. The dependent variable was calculated by the score in the kanji tests. This construct will be referred to as Kanji Meaning Score, and the score for grading was: 0: Incorrect and 1: Correct.

Answers which were semantically appropriate, although different from the translations provided by the LV System, were considered to be correct. The aspect of knowledge of the kanji’s shapes was embedded in the evaluation of the kanji’s meaning, since in order to answer with the correct meaning of a kanji, first learners need to recognize the shape of that entire kanji, which is usually done (at least in the case of a beginner) via processing the shapes of the individual blocks that the learner consciously or unconsciously recognizes within that kanji.

For experiment 2, in a kanji deconstruction test, used as a pre-test and later as a post-test, learners were asked to select their preferred deconstruction for each of the 20 kanji in the test. While every option was assigned a certain number of points, this did not appear in the test in order to prevent learners from being influenced by the point system and consequently generating unreal data. "Personal kanji deconstruction level" (maximum score: 100) represents the accumulation of points that the participants scored after selecting all the 20 kanji deconstruction options of their preference. This item type was used to measure the level at which learners personally visually deconstructed the given kanji. This construct will also be referred to as "deconstruction visualization". The whole unit deconstruction visualization (which occurs when the user chooses to visualize a given kanji as only one block) corresponds to the highest number of points. The smaller the number of blocks the learners visualized in a single kanji, the more the learners increased their scores, as these learners were able to visually process larger and more complex blocks.

6. Results and Discussion
The results of the two experiments showed that effectively our research hypotheses proved to be true: in experiment one, all participants in group G2 acquired a substantial improvement in kanji knowledge, mean=30.88, while in group G1 mean=15.38, see Fig. 5. The results of experiment two were also positive.

The results of both experiments, summarized in Table 2, are presented below, corresponding to the conceptual and operational research questions.

6.1. Experiment 1: Effects of the LV Approach on the Acquisition of Kanji’s Shapes and Meaning
The research question of the present study was "Would there be a benefit to guiding kanji learners to synthesize blocks using their visual cognition in
choosing from predefined deconstructions of kanji?”, and this evolved into the hypothesis: “Do learners studying kanji with the LV Approach acquire knowledge of kanji’s shapes and meanings at a significantly accelerated rate by using their own visual cognition in developing memory skills?” Our results show that the answer is positive.

Therefore, the proposed LV Approach, which incorporates the learners’ own visual cognition in selecting from multiple different possible ways of deconstructing given kanji, does enhance kanji-learning results.

After the pre-test, G1 showed the following values: mean=10.42, SD (Standard deviation)=2.80, SEM (Standard Error of the Media)=0.57, and Var=7.82; and G2 showed mean=10.21, SD=1.89, SEM=0.39 and Var=3.56. After the post-test, the values were: for G1, mean=15.38, SD=2.65, SEM=0.54, and Var=7.03. And for G2, mean=30.88, SD=4.88, SEM=1.00, and Var=23.77.

The t-test conducted to compare Kanji Meaning scores in order to determine the relationship between the multi-deconstruction treatment and acquired knowledge of the meaning of kanji showed that there was a notably high and statistically significant positive correlation between them.

The results of the performed t-test indicated there was a significant difference between the two sets of data at the .01 level. (t(46)=13.68, p<.01). These data therefore tend to support the alternative hypothesis that, “Learners, while studying kanji with the LV Approach, acquire knowledge of kanji’s shapes and meaning at a significantly greater rate by using their own visual cognition in developing memory skills.”

6.2. Experiment 2: Effects of the LV Approach on the visual deconstruction of shapes

For further validation of the effect of the LV Approach on the acquisition of kanji’s shapes the second experiment was conducted. The hypothesis of this experiment deals with the question “Do kanji learners receive an impact in their current kanji deconstruction score (mean number of blocks visualized/kanji, with a higher score corresponding to fewer blocks per kanji) after working with the LV Approach?”. The answer to this question, according to the experiment performed, was affirmative. The statistical data of the groups in the pre-test were: for G1, mean=32.96, SD=5.59, Var=31.26; for G2, mean=33.17, SD=5.45, Var=29.71; and in the post-test: for G1, mean=36.00, SD=5.32, Var=28.35; for G2, mean=52.13, SD=8.87, Var=81.46. Figure 6 shows the analysis of the results of the pre-test and post-test scores in kanji deconstruction visualization. It compares the pre-test and post-test score values for each of the 24 learners in each group. The results say that the 24 learners of G2 acquired the ability to visualize kanji in a more holistic way, i.e. with fewer blocks. The descriptive statistics for the mean of the deconstruction level updates in G2 compared with the ones of G1 suggest that the use of the learner-guided deconstruction technique facilitated significant improvement in the participants’ initial level of preferred visual kanji deconstruction. The results of the performed t-test indicated there was a significant difference between the two sets of data at the .01 level. (t(46)=7.63, p<.01).

6.3. Discussion

The experiments revealed evidence that there is a positive cognitive effect to guiding the kanji learner with suitably preestablished sets of possible deconstructions. Learners not only learn kanji’s meanings, but also acquire the ability to visualize them in fewer and fewer (and more complex) visuospatial-temporal blocks, moving towards the way in which the Japanese view kanji. This fact conveys the efficiency and efficacy of the LV Approach applied in our LV System. Further, these results confirm previous findings (Gamage 2003) that learners of Japanese with an alphabetic language background tend to rely more on visual strategies.

The results of the experiment two also suggest that whether or not the LV Approach is used, kanji learners tend to adapt their own way of comprehending manageable visual substrutures within each kanji. Some learners could be less naturally adept at comprehending visual inputs with multiple elements. These learners could be excessively distracted when visualizing many
groups of strokes within a single kanji. Therefore, the importance of helping learners to update their kanji deconstruction “map” to visually divide individual kanji into progressively fewer groups of strokes is evident; this process becomes smooth with the LV Approach, most importantly at the speed of the learner’s personal cognition.

7. CONCLUSION AND FUTURE WORK

In this study, we proposed and described a new approach for kanji-learning, the Learner’s Visualization (LV) Approach, which is based on harnessing the learner’s own visual cognition to accelerate the learning process.

Our work has not only proposed a novel approach, but has also proven the existence of the positive effect of this approach as implemented in an educational tool, our LV System, on learners’ ability to recall kanji’s shapes and meanings.

It is noteworthy that the core of the educational technique of the LV System lies in its strategy to help learners to develop the ability to synthesize the perceived individual blocks within kanji, and consequently visualize kanji in fewer and fewer (and more complex) blocks, as a result of accelerating their cognitive processing of kanji.

Furthermore, the difference between the component approach and the LV Approach is based on the fact that the former focuses on a purely analytical learning process, while the latter features both analysis and synthesis of visuospatial-temporal blocks in a synergetic way. Thus the LV Approach allows learners to synthesize kanji’s blocks through the use of: a. the learners’ visual cognition and b. suitable predefined deconstructions of kanji.

7.1. Summary of Achievements and Limitations

7.1.1. Achievements

1. A new approach for kanji-learning systems, the Learner’s Visualization (LV) Approach, which is based on a fusion of three elements: the learner’s visual cognition, block analysis/synthesis, and multiform deconstructions of kanji. This approach could enhance the performance of future kanji-learning CALL systems.

2. Proof that guiding kanji learners to synthesize blocks using their visual cognition in choosing from predefined deconstructions brings positive effects in developing memory skills to improve recall of kanji’s meanings and shapes.

3. Proof positive that this technique of guiding learning through multiple possible predefined deconstructions can be successfully carried out in kanji learning systems.

4. Development of an effective technique for learning kanji’s shapes and meaning, taking into account the personal visual perception of learners.

5. Evaluation of the effectiveness of this technique with the first implementation of a Learner’s Visualization (LV) System tested on foreign learners of the Japanese language.


7. Integration of learners’ personal perspectives and individual cognition into the learning process, making learners active participants in a domain of study where up until this point they have been mainly passive receptors of educational material.

7.1.2. Limitations

Participants in the present study were exclusively beginning students.

7.2. Future Work

• To implement the LV System for kanji words in context and not just isolated kanji.

• To incorporate adaptive learning functions and
pronunciation.
• To compare the LV Approach with every approach and method of kanji-learning currently in use, including for intermediate and advanced students, in order to obtain more comprehensive results. These comparisons may help better determine the effectiveness of the LV Approach, as well as its strengths and weaknesses.
• To extend the LV Approach’s domain of benefit to retention of phonological, morphological, and syntactic features of Japanese vocabulary words in context, for an extended period of time, and with full comprehension.
• To enrich the LV System’s functionality with listening and speaking activities, as well as other activities which help learners acquire productive knowledge of kanji by promoting the use of acquired knowledge.

Time passes irrevocably, as the classical Roman poet Publius Vergilius Maro said. With the passage of time, well-founded approaches to the study of kanji mature and gain acceptance, or they give way to new ideas. First we had the Radical Approach, which comes from ancient times, in which each radical provided learners with its vague semantic value. The current kanji-learning phenomenon is in the Component Approach, which leads the learner to unidirectionally analyze, passively staring at kanji, waiting to recognize the shapes he/she is expected to see, all while perfectly capable of recognizing and synthesizing shapes within that kanji, if only his/her personal visual cognition could be allowed to take the reins and work with the shapes he or she naturally recognizes. Now we propose the Learners’ Visualization Approach (or LV Approach for short), which finally allows learners to take the reins as they select the number and layout of visual shapes closest to that they themselves recognize within a particular kanji, and gradually analyze, actively define, and synthesize these shapes (“visuospatial temporal blocks”) at their own pace and according to their own visual cognition. Though it has just now been proposed, we believe the Learner’s Visualization Approach has the potential to become the third wave in the study of kanji.

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