An On-Line Japanese Handwriting Recognition System integrated into an E-Learning Environment for Kanji

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Chapter 1

Conceptual Design of Kanji-Coach

1.1 Requirements of a Kanji Teaching E-Learning Application

1.1.1 General Considerations

In order to create a concept for a Kanji teaching application, a number of different aspects need to be taken into consideration. These aspects emerge from the academic background concerning the Japanese script, pedagocical and didactic knowledge about teaching languages and general conceptions of e-learning applications.

Many efforts in designing e-learning applications are focused around the teacher's view on learning. For designing an e-learning application that is useful to students, the students view needs be taken into account (Alexander and Golja 2007). Ivašin (2009) critisises the technical dominance in e-learning and e-teaching processes, as the conceptual software designs are not always supporting the didactic purpose of the software. Therefore, the user view should be taken into account when conceptually designing an e-learning application. The requirement of a *user-focused design* follows directly from this view.

For online e-learning, it is a known that readers only scan the textual information displayed. Therefore it is not useful to provide a user with large blocks of text, but rather with smaller chunks that encourage skimming over (Hamid 2001). It can be expected that the fact that an e-learning process happens online does not greatly affect the user behaviour. Therefore, the observations made for online e-learning can probably be applied to offline desktop application based e-learning. The requirement of *keeping textual information short and concise* derives from the observation.

If e-learning is considered as a learning method in higher education, *blended learning* seems to be the most suitable form of e-learning. That means, combining classroom activities with e-learning methods (Hettinger 2008; Kahiigi et al. 2008). Language learning is not necessarily considered as higher education. In case of studying Japanese, with its specific difficulties in language and the script, language learning is taken to an intellectual level that is at least close to higher education. Therefore, an e-learning application for any aspect of the Japanese language should not have the pretensions of posessing the capability to *teach Japanese*. Japanese is a complex language with a complex script. Therefore, e-learning applications should aim at supporting a learner's classroom efforts of studying the language. The requirement of *focussing on a specific language aspect* can be drawn from this reasoning. The prototype system designed in this work does not aim at being a complete system, but rather offers individual learning components from which a user can choose what type of learning and which component best supports his study.

1.1.2 Classification of a Kanji Teaching Application

In section **??** different types of e-learning systems have been discussed. In the course of designing a prototype system, design choices need to be made. The design choice for the prototype will be an offline e-learning system, that runs on a desktop PC. This design choice does not follow a conceptual requirement, in fact it ignores Ivašin's (2009) criticism of technical dominance in e-learning systems. The choice is a purely technical choice, yet, it is driven by a conceptual requirement. The purpose of the e-learning environment is to test to what extend a handwriting recognition engine can help studying the Kanji. In order to examine that research question, the handwriting recognition needs to be implemented and integrated with the e-learning system. Thus, the design choice for an offline system was inevitable in the sense that the technical limitations of on-line applications form an obstacle for pen input of characters and fast recognition procedures.

According to the definition given by (Richert 2007) the Kanji teacher prototype is a *computer based training* (CBT) system, as it does not use the Internet for communication or a webserver for storage. According to her research, another criterion for an identifying offline systems is that they are offered for distribution on CD-ROM or floppy disk. That criterion can be regarded as obsolete, as it refers to specific storage media. Even if a higher

level of abstraction is used to describe the criterion, it is still obsolete, since *a passive storage medium* is not necessary to describe what the criterion actually tries to define. The criteria concerning communication and data storage are useful to confine different types of e-learning applications. Additionally, *installability* can be used as a criterion for offline e-learning systems. *Installability* here refers to *the possibility to install a software on a computer system*, not the *ease of installation*, which is defined in ISO9126 as *installability* as well (Chua and Dyson 2004). The ISO9126 type of installability will be taken into account during the software evaluation, which is reported in chapter **??**.

Concerning the level of interactivity described in section **??** the prototype designed in this work is aimed at a level higher than level *(**??**) Changing the content of a component*. It is targeted between the levels *(**??**) Generating objects or the content of a representation* and *(**??**) Constructive and manipulative actions through situation-dependent feedback*. Concretely, a user can:

- Change the ideal shape of a character by storing a new gold standard.
- Create new characters and their descriptions
- Receive situation-dependent feedback even on the newly created characters, due to the nature of the error recognition algorithm that evaluates mathematically the distance between a gold standard character and a an input. Additionally, characters are analysed structurally, therefore new characters added by the user will automatically be classified and arranged among the other characters in the database of the system.

Thus, based on the levels of interactivity (Richert 2007), it can be concluded that the prototype provides a very high level of interaction. The levels serve as an evaluation measurement for the quality of e-learning applications.

1.1.3 Conceptual Issues for E-Learning of Kanji

An e-learning application for Kanji should be an e-learning application for vocabulary at the same time. It is conceptually not useful to split those two learning tasks (Stahlmann 2004). Learning Kanji and Hànzì is a visual task. Learners need to focus on many little details concerning a character. For example, the character 曜 contains 18 strokes that are difficult to distinguish from each other in a regular script size of 11pt. It is those details that make it difficult for a learner to remember a character. Thus, it is important to direct and guide the learner's perception of the characters towards a construct of Radicals, rather than a combination of a large number of strokes (Stahlmann 2004). When attempting to split characters into conceptual sub units for the ease of a learner, two different approaches lend themselves to this goal.

Firstly, splitting the characters into certain strokes. There are 26 original strokes in the writing system and each shape in all the characters can be drawn with a combination of those strokes (**?**). This approach does not seem to ease the task of memorising the Kanji. It may be fairly easy to memorise 26 strokes, but the fact that around 2000 Kanji, necessary for reading Japanese, consist of these strokes does not imply that memorising those becomes any less difficult.

Secondly, splitting the characters into graphemes. There are several shapes in use in the Japanese and Chinese writing system. There are 79 graphemes in use (**?**). Using graphemes as a conceptual unit for a learner seems much more useful than employing the strokes as a direct sub unit of the Kanji. Memorising all the graphemes may help a learner to study the Kanji, because all sub shapes of the characters are known. However, graphemes do not necessarily bear a meaning. Therefore, seen from a perspective of perception and cognition, the coherence between the different parts of a Kanji would be purely visual. That can help learners with an outstanding visual memory, but probably not the majority with an average visual memory.

Thirdly, splitting the characters into Radicals. Radicals are the conceptual sub units of Kanji characters and they bear a meaning of their own. The number of Radicals is larger than the number of graphemes, but not all Radicals are in use and some graphemes are Radicals themselves at the same time (**?**). The Radicals do not only bear a meaning, but also have a function in character formation (see section **??** for typology of the Kanji). In order for a learner to memorise the Kanji, it seems useful to grasp the concept of Kanji typology and therefore character formation. Equipped with the rules of character formation and a number of Radicals the brain can link different parts of a Kanji character with other parts and other characters. For example when studiying phonograms, the majority of the Kanji characters, knowledge about the pronunciation of the phonetic Radical will help the learner.

Among those three possibilities it seems most suitable to use a combination of the second and the third. Conceptually, the characters will be split into Radicals, but the system must know about the concept of a grapheme, too. Ideally, the system would have data that distinguishes both.

1.2 Approaching the Specific Difficulties of the Japanese Script

Section **??** deals with the typical problems that learners face when studying the Kanji. The Japanese script inevitably bears some difficulties when attempting to study it. The application should care for these problems

by supporting these issues.

1.2.1 Character Learning Aspects

1.2.1.1 Character Repetition

In section **??** the pure repetition of grammatical structures as a learning method has been critisised. The system should account for that by not just forcing the user to reproduce fixed structures. In fact, it should leave room for creativity.

1.3 Integration of HWR Into the Learning Process

1.4 Handling Errors

1.4.1 Motivation for Error Recognition

1.4.2 Possible Sources of Error When Writing Japanese Characters

error handling, see page 58.

See notes on paper, seite 58 - for example stroke number and stroke sequence - length of strokes - stroke velocity

1.5 Use Cases

Figure 1.1

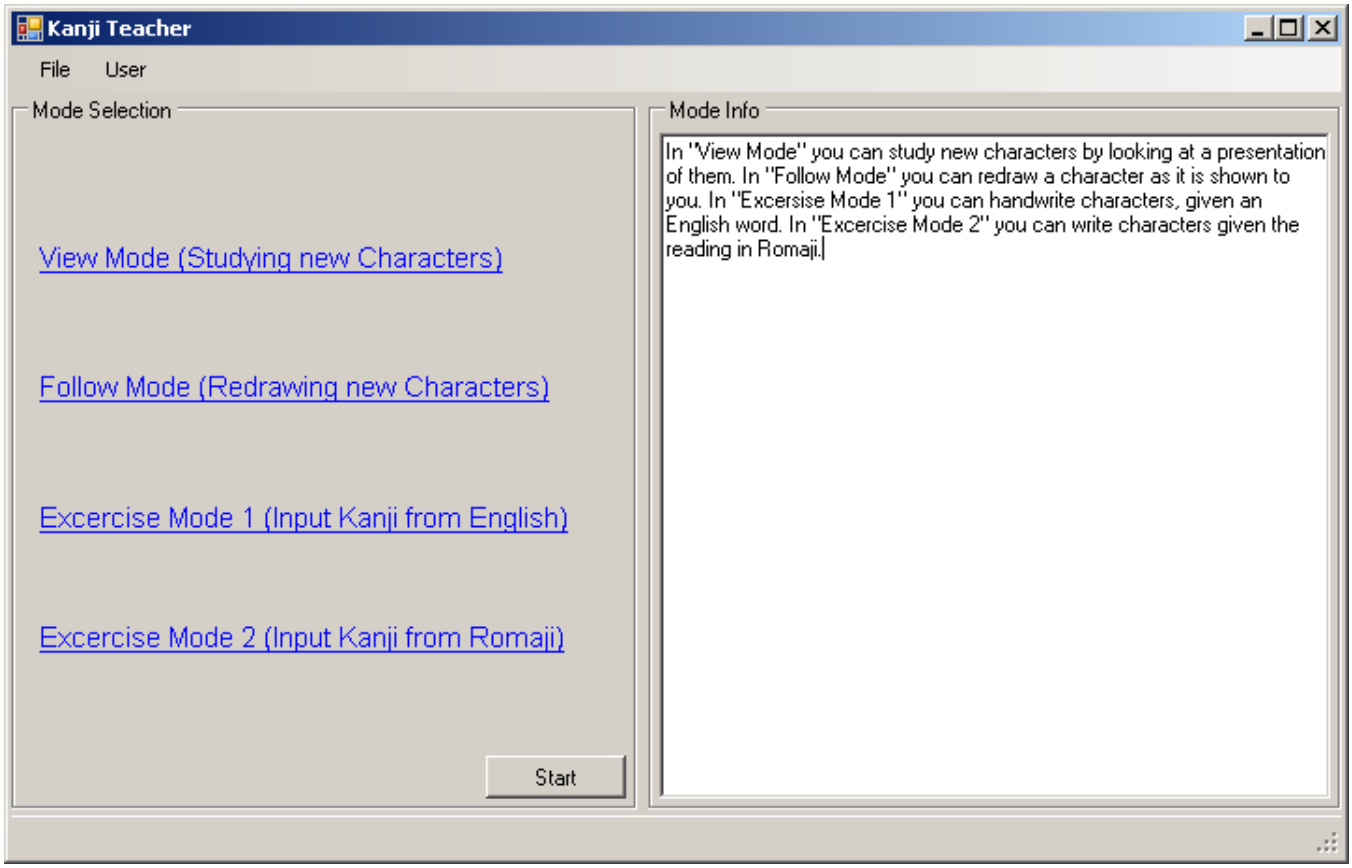

Figure 1.1: Startup screen

Figure 1.2
Figure 1.3

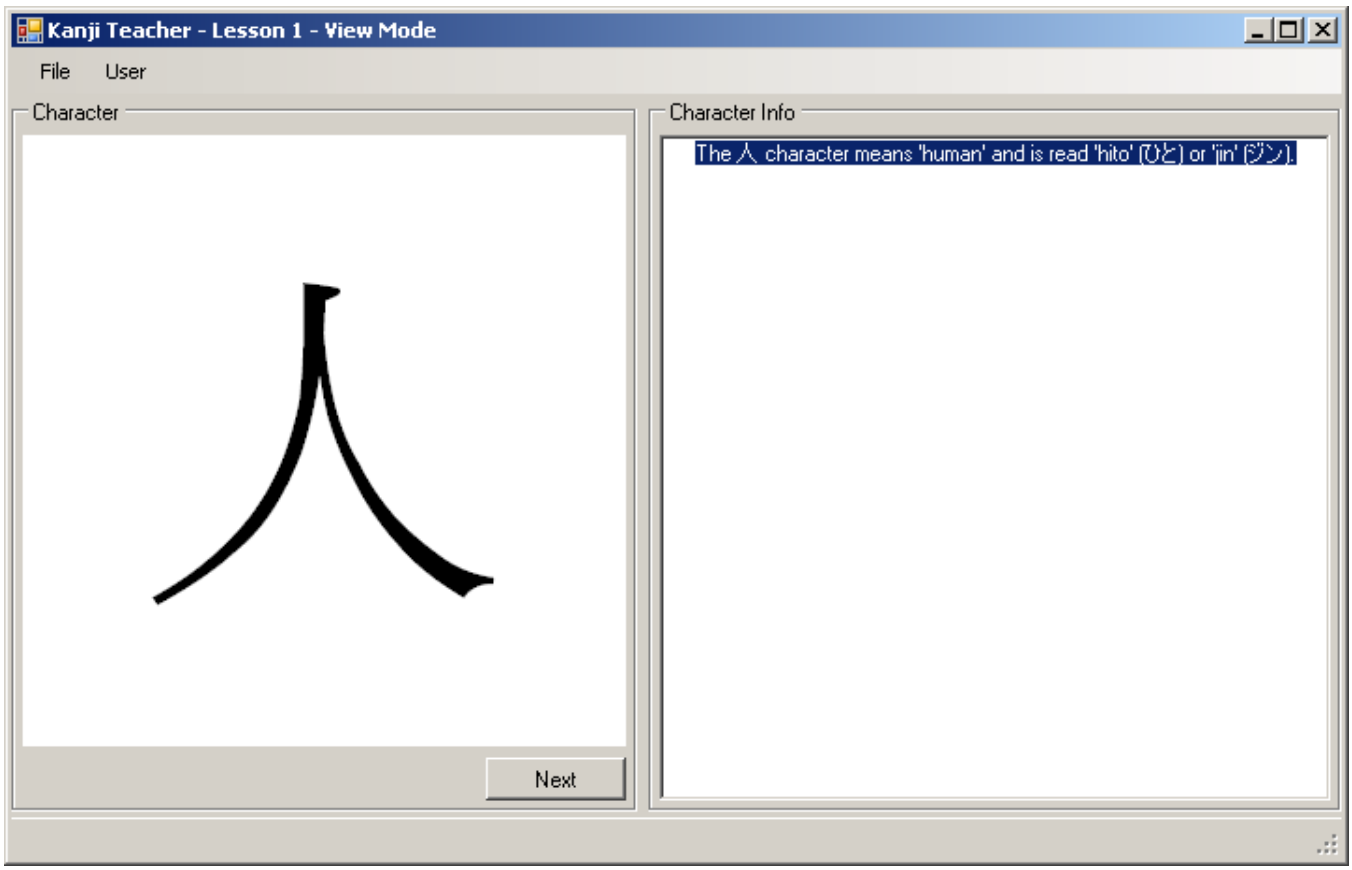

Figure 1.2: Startup screen

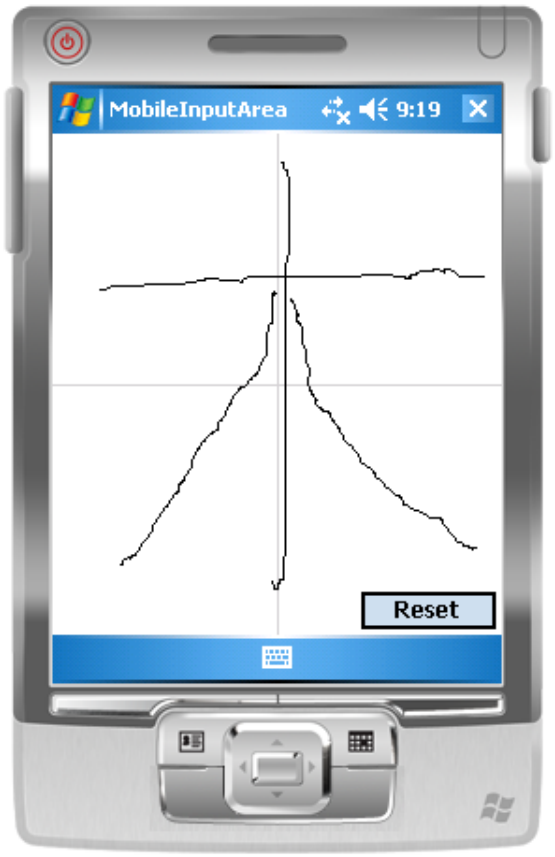

Figure 1.3: Startup screen

References

Alexander, S. and T. Golja (2007). Using Students' Experiences to Derive Quality in an E-Learning System: An Institution's Perspective. *Educational Technology and Society 10*(2), 17--33.

Chua, B. B. and L. E. Dyson (2004, Dec). Applying the ISO 9126 Model to the Evaluation of an E-Learning System. In *Proc. of ASCILITE 2004*, Perth, Australia, pp. 184--190.

Hamid, A. A. (2001). e-Learning: Is it the "e" or the Learning That Matters? *The Internet and Higher Education 4*(3-4), 311--316.

Hettinger, J. (2008). *E-Learning in der Schule (in German)*. Munich, Germany: kopaed Verlag.

Ivašin, M. (2009). Lernen und Technologie (in German). In B. Mikuszeit and U. Szudra (Eds.), *Multimedia und ethische Bildung*, Chapter 5.5, pp. 635--648. Frankfurt am Main, Germany: Peter Lang.

Kahiigi, E. K., L. Ekenberg, H. Hansson, F. Tusubira, and M. Danielson (2008). Exploring the E-Learning State of Art. *The Electronic Journal of E-Learning 6*(2), 77--88.

Richert, A. S. (2007, Dec). *Einfluss von Lernbiografien und subjektiven Theorien auf selbst gesteuertes Einzellernen mittels E-Learning am Beispiel Fremdsprachenlernen (in German)*. Ph. D. thesis, RWTH Aachen, Aachen. Manuscript committee: Prof. Dr. phil. Rudolf Beier, Prof. Dr. phil. Uwe Michelsen.

Stahlmann, R. (2004). Didaktische, inhaltliche und funktionelle Optimierung einer selbst entwickelten Chinesischlernsoftware (in German). Master's thesis, Offenburg University of Applied Sciences, Offenburg, Germany. Manuscript committee: Prof. Dr. Roland Riempp (supervisor), Prof. Dr. Thomas Breyer-Mayländer.

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