Xamobile: Comparing mobile text input methods for historical African languages

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Introduction

Languages is an emblem of identity. Preserving languages is vital in saving cultural wealth and important ancestral knowledge embedded in these languages.
Many African languages are heading for extinction and some are already extinct (like |Xam, previously spoken in the Western Cape).
Records of the language currently existing in a digitized dictionary. (Figure 1)

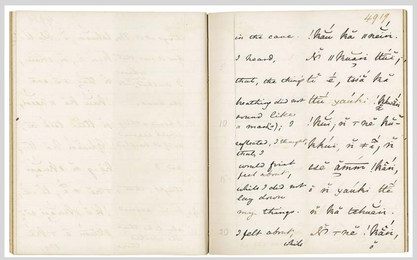

Figure 1

Background

- The corpus of |Xam text document is complex and can't be easily input on a keyboard or small screen.
- Complex - with diacritics above, below, above and/or below character(s). (Figure 2)
- No Language Model (Figure 3)

Figure 2

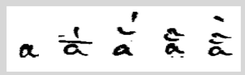

Figure 3

Objective

To compare the accuracy and speed of entry of QWERTY, T9, Pinyin Script and Hierarchical input methods using |Xam text on mobile devices. (Figure 4-7)

Figure 4. QWERTY

Figure 5. T9

Figure 6. PINYIN SCRIPT

Figure 7. HIERARCHICAL

Hypotheses

Text of the language should be preserved and mobile text entry could help. Figure 8 shows images of |Xam text with diacritics from the notebooks and their transcriptions.
|Xam consists of about 35000 unique characters. These characters consist of single/double characters with diacritics below or above or above and below with the inclusion of special clicks and symbols.

Figure 8

Research Questions

1. How do the XWERTY, T9, Pinyin Script and Hierarchical input methods compare in terms of accuracy for |Xam text?
2. How do the XWERTY, T9, Pinyin Script and Hierarchical input methods compare in terms of Speed of entry for |Xam text?

Methodology

- Baseline Study. Figure 9 shows the designed |Xam font required for entry of single/double characters with diacritics.
- User Centered Design
- Prototyping. (Figure 10)
- Development (Figure 11)
- Testing and Evaluation (Figure 12)

Figure 9

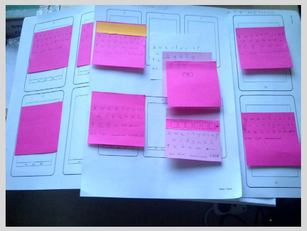

Figure 10

Development

After several design iteration cycle with our focus group, we feel confident that it fits requirement and everything that has been learned through the iterated steps of prototyping and evaluation are integrated to produce the final prototype to be used for experimentation (Figure 11).

Figure 11: Final Prototype for QWERTY, T9, PINYIN SCRIPT and HIERARCHICAL entry methods

Experimentation

Population Size

- . 50 participants recruited for a between-group experiment by using all the methods using randomized Latin square method (Figure 12).

Apparatus

- |Xam Line Text (Source: gold standard data used in AHR and TBL)
- . Android Touchscreen mobile phones
- 4 Prototype Input Methods

AHR : Automatic Handwriting Recognition [Williams and Suleman 2011]
TBL : Transcribe Bleek & Lloyd [Ngoni and Suleman 2013]

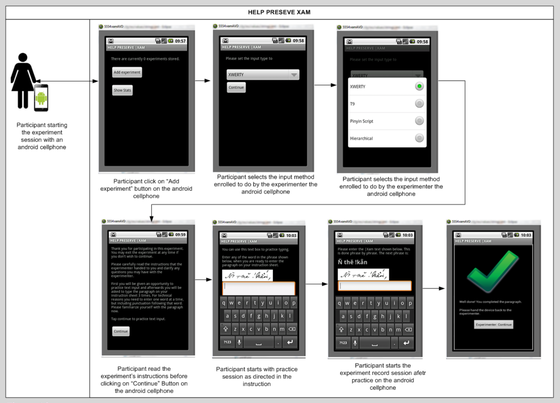

Figure 12

Results and Discussions

$$WPM = \frac{|T| - 1}{S} * \frac{60}{5}$$

$$KSPC = \frac{|InputScream|}{|TranscribedText|}$$

$$Total\ Error\ Rate = \frac{INF + IF}{C + INF + IF} * 100\%$$

$$MSD\ Error\ Rate = \frac{MSD(A,B)}{\overline{S_Q}} * 100\%$$

- WPM is the Word Per Minute metric for measuring speed of text entry. *|T| is the length of transcribed |Xam text*
- *S is the duration in seconds*
- *Note that the constants 60 and 5 represent conversion metric for minute and average word length of |Xam text.*
- *KSPC is the keystrokes Per Character*
- *|InputScream| is the total number key-press for the presented |Xam text*
- *|TranscribeText| is the total number key-press required using a particular input method for the presented |Xam text*

INF represents the total number of errors made but not corrected in the |Xam text
IF represents the total number of errors made and corrected in the |Xam text
C represents the total number of correct keystrokes in the |Xam text

Conclusions

Quantitative data would be collected to calculate WPM, Total Error Rate and MSD metrics for the purpose of comparison

Acknowledgement

Center of Excellence in Broadband networks and applications

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