Prototyping Input Methods on Touch Devices:
Our experience and examples

IUC38: Touch the Future

http://xkcd.com/1284/
Introduction

- Escaping our past
- Emerging markets and languages
- The DISCUS principles
- Keyboard prototypes
Escaping our past

- Is it possible to escape the legacy of teletype machines, typewriters, and keyboards?

- English:
  - Devices regularly released with non-QWERTY
  - A-Z, Dvorak, and esoteric layouts
  - T9 initially successful on tiny devices
  - But: market leaders now all use QWERTY
It’s a German QWERTŸZ – the grand daddy
It’s not QWERTY. But is it usable?
As used by NSA – special Secret Code button
No idea.
T9 ... not QWERTY ... significant success
Optimus.
QWERTY with one less row. Clever.
It looks weird, but it’s still QWERTY!
It looks weird, but it’s still QWERT!
It looks weird, but it’s still QWER... um... GT?
Touch innovation – literally around the edges!
What do those images tell us?

There are benefits to the status quo

- Less for users to learn
- Familiarity with input method reduces ‘strangeness barrier’
- Reduced technical support for input method
- Faster to market
Emerging markets & languages

- Do they have an input method history?
- Major changes are possible
  - Japan moved to Romaji
  - China moved to Pinyin
- Can we do better than English?
- How can we optimise layout for acceptance?
The DISCUS Principles

- Discoverability
- Intuition
- Simplicity
- Consistency
- Usability
- Standards
DISCUS – Discoverability

- Make it easy to find all letters
  - Even rare ones

- Reduce experimentation
  - Experimentation typical user experience today
  - Most English users never try typing accents

- Keyboards for languages with more characters than keys are rarely obvious to a first time user
Can you type É on Swiss-French keyboard?
Can you type É on Swiss-French keyboard?
No, [Shift] + [é] won’t work

You have to type [Caps Lock], [é]
When iPhone was released, it felt ‘magic’ and ‘intuitive’ compared to other devices at the time.

Hard to quantify; you know it when you have it.

Examples:
- Holding a key to show related characters
- Double-tap shift key to engage Caps Lock
- Sliding from shift key to letter key for upper case
- Double-space signifies end of sentence and inserts a full stop automatically
Temptation to include lots of extra characters
- Inverse pressure to Discoverability

Divorce encoding and input
- ZWJ, ZWNJ, LRE and more! Great for geeks!
- Composed, decomposed and other rotten characters
- Input order vs encoding order
Six characters on each key? Wonderful!
  - But too noisy for most users

A keyboard doesn’t need to do everything
  - We have a key to switch keyboards
  - One keyboard per language
  - Specialized keyboards for specialized uses
How closely does your input method correspond to:

- Orthographic conventions?
- Phonetic – spoken word?

Writing systems are typically neither consistent nor terribly logical

- Yet scripts – even English – do have some internal consistency
- Do you understand the script?
Understanding the structure of the script key to a good consistent design
- Linguistic analysis

Well-researched layouts are more successful
- Many users will not have the level of understanding of the script required to design a good keyboard layout
- However, they will intuitively feel that the keyboard works better for them
Questions to consider:
- Is alphabetic order sensible?
- Or group by sound?
- Which letters are rare (frequency analysis)?
- Common sequences & pairs?

Frequency Analysis (Dvorak, Colemak?)
- Small touch devices reduce benefit
Keyboard design may look amazing on paper.

Great concepts often feel awkward in practice.

Test is only way to be sure:
- Experienced users ... and novice users
- Native speakers ... and foreigners
Usability Rules of Thumb

- Minimize animation and visual effects
- Number of rows: 4 – 5 (phone – tablet)
- Number of keys per row: 10 – 13
- Control keys: don’t move or resize across layers
- Layer keys: toggle back to previous layer
DISCUS – Standards

- Unicode

- Legislated and societal requirements:
  - Accessibility laws
  - Mandated characters (e.g. currency symbols)
  - Consistency with existing layouts (e.g. INSCRIPT)

- Consider cross-device experience
Prototype Layouts

- Conceptual Layouts
- Ignore *Standards* in experiments: DISCUS
- Lao Syllabic
- Thai Satellite
- Amharic Fidelity
Modern Lao is very regular and allows optimised input with knowledge of allowable combinations.

- 27 consonants (1 rare)
Lao Vowels

- 19 vowel symbols

earer and ear are consonant and vowel

- Vowel symbols combined to form 39 vowels. 25 open syllable vowels.
Lao Tones and Marks

- 4 tone marks – 6 spoken tones
- A few other marks.

A Consonant-Vowel-Consonant-Tone syllable-based input method is achievable.
Lao Syllabic – Live Demo

- Live demo (Chrome)
  - ບໍ່າຫຼ່ຽມ - hello
  - ບ້ານ - city
Lao Syllabic – Challenges

- Extra keystroke to finish most syllables
  - This does not meet our *Intuition* bar
  - Spacebar mitigation: returns to consonant layer
    - Does not insert a space unless pressed a second time

- Support for irregular combinations
  - Loan words, archaic words, expat Lao
  - Switch layers manually
Thai Satellite – Thai

- Thai closely related to Lao
  - Fewer orthographic reform cycles

- 44 consonants
- Over 50 vowels
- Complex spelling

- Slightly different approach required
Thai – Standard vs ‘Satellite’

- **Standard:**
  - Typewriter
  - Small keys
  - 5 rows

- **Prototype**
  - Common consonants
  - Larger keys
  - 4 rows
Thai Satellite – Approach

- Constructing a syllable around the base letter.
  - Neither orthographic nor phonetic, but a comfortable compromise.
- Keyboard dynamically reorders backing store as it constructs the syllable
- Hides rare consonants under related base consonant
- Similar approach in Apple’s Kana keyboard.
Thai Satellite – Live Demo

- Live demo
  - แม่น้ำ – river
  - นี่ vs นี้ – this vs now.
  - เมือง – city
Thai Satellite – Advantages

- Syllable order more natural
  - Consonant first, then vowel, tone in single gesture
  - Final consonant a second gesture
- User does not have to think about backing store order but rather the word
- Efficient
  - 1 gesture for open syllables
  - 2 gestures for closed syllables
Thai Satellite – Challenges

- Difficulty showing vowel popup around keys on edges of screen
  - Only an issue on phone-size devices
- Support consonant clusters with surrounding vowels
- A few vowels not yet included, e.g. รร
- Presentation and style
Thai Satellite – More Possibilities

- Smooth Gestures, e.g. เมือง = curl gesture + tap
  - Gesture should not need pauses
  - Requires heuristic elimination of invalid combinations
Amharic is an abugida

- Each *fidel* represents a consonant + vowel sound
- 34 consonants, 7-12 forms = 276 fidel
- V, VC, VCC, CV, CVC, CVCC syllable forms
  - V – vowel; C – consonant

- Example: [d] consonant + vowels

<table>
<thead>
<tr>
<th>d</th>
<th>እ</th>
<th>ኦ</th>
<th>ኧ</th>
<th>ከ</th>
<th>ኩ</th>
<th>ኪ</th>
<th>ካ</th>
<th>ኬ \u0111</th>
</tr>
</thead>
<tbody>
<tr>
<td>[d]</td>
<td>de</td>
<td>du</td>
<td>di</td>
<td>da</td>
<td>de</td>
<td>d(ə)</td>
<td>do</td>
<td>d\u0111a</td>
</tr>
</tbody>
</table>
### Amharic Fidelity – Characters

| ድ | ዶ | ዷ | ዸ | ዹ | ዺ | ዻ | ዼ | ዽ | ዾ | ዿ | ጊ | ጋ | ጌ | ግ | ጎ | ጏ | ጐ | ጑ |
| ዲ | ዳ | ዴ | ድ | ዶ | ዷ | ዸ | ዹ | ዺ | ዻ | ዼ | ዽ | ዾ | ዿ | ጊ | ጋ | ጌ | ግ | ጎ |
| ጏ | ጐ | ጑ | ጒ | ጓ | ጔ | ጕ | ጖ | ጗ | ጘ | ጙ | ጚ | ጛ | ጜ | ጝ | ጞ | ጟ | ጠ | ጡ |
| ጢ | ጣ | ጤ | ጥ | ጦ | ጧ | ጨ | ጩ | ጪ | ጫ | ጬ | ጭ | ጮ | ጯ | ጰ | ጱ | ጲ | ጳ | ጴ |
| ጵ | ጶ | ጷ | ጸ | ጹ | ጺ | ጻ | ጼ | ጽ | ጾ | ጿ | ᄀ | ᄁ | ᄂ | ᄃ | ᄄ | ᄅ | ᄆ | ᄇ |
| ᄈ | ᄉ | ᄊ | ᄋ | ᄌ | ᄍ | ᄎ | ᄏ | ᄐ | ᄑ | ᄒ | ᄓ | ᄔ | ᄕ | ᄖ | ᄗ | ᄘ | ᄙ | ᄚ |
| ᄛ | ᄜ | ᄝ | ᄞ | ᄟ | ᄠ | ᄡ | ᄢ | ᄣ | ᄤ | ᄥ | ᄦ | ᄧ | ᄨ | ᄩ | ᄪ | ᄫ | ᄬ | ᄭ |
| ᄮ | ᄯ | ᄰ | ᄱ | ᄲ | ᄳ | ᄴ | ᄵ | ᄶ | ᄷ | ᄸ | ᄹ | ᄺ | ᄻ | ᄼ | ᄽ | ᄾ | ᄿ | ᅀ |

This table represents the characters of the Amharic language.
Could use gestures, but tried something different

Multi-tap instead of slide gestures

Uses 5 rows

- Row 1: blank space
- Rows 2-4: initial consonants.
- Row 5: space + controls.
Isolate or final form fidel keys on base layer

Each isolate fidel key triggers display of alternate forms across top row.

Only 26 of 34 base fidel shown.
  - Related consonants are under slide menu.
Amharic Fidelity – Base Layer

Keyboard Test Host

 فلالا

Install Keyboard into native Keyman
Amharic Fidelity – [d] layer
Amharic Fidelity – Advantages

- Discoverable
  - Users often find it hard to locate some forms on desktop; this should not happen here

- Intuitive
  - Syllable combinations natural to enter
  - Never forced to switch layers manually

- Consistent
  - Exploits language structure for efficient input
Base layer could be better organised?
  - Still based roughly on QWERTY

Gestures may be even more efficient for selecting other forms
DISCUSSION

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