

Towards More Interactive Use of Device Keys

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ABSTRACT

This paper discusses a few novel ways of interactive and flexible use of physical keys in a device like a mobile phone. We believe that adding certain new kinds of interactive elements into user interface designs can improve usability, user experience and efficiency of mobile devices.

General Terms

Design, Experimentation, Human Factors.

Keywords

Interaction, input/output, keypad, keyboard, display, softkey, function preview, input preview, touch sensitivity.

1. INTRODUCTION

The biggest dilemma in user interface design of mobile devices has been, and still is, that a lot of input and output functions must be crammed in a very small space.

We can this time consider audio input and output out of the scope, since those functions are not very demanding for the use of device space. Visual output – whatever appears on a screen – and user input via keys, switches, touch sensitive areas and so on are the critical ones.

For most users the mobile device (phone, audio/media player...) is more an output device than input device: the screen lets you view content like web pages, emails, calendar, contact data and so on. Input in many cases means merely browsing the data and selecting items, which can be done with a few physical interaction components. An important exception is writing notes, messages or mails, which is typically done with some kind of keypad.

The emphasis on output leads to thinking that a touch screen suits mobile usage well, since it maximizes the available output area, and offers completely free design of input elements on screen depending on context. While this is largely true, a touch screen interface has serious drawbacks as well:

- Input and control functions take space from actual content, diminishing the efficiency of the screen. This is especially the case with interfaces intended for finger use, since the items need to be relatively large to be usable. A virtual keyboard steals a lot of screen real estate from the content.
- Lack of natural tactile feedback: the user can't feel the elements on screen. This can be simulated with vibrotactile feedback to some extent, but that is hardly

as effective as real physical keys. So more visual concentration is needed from the user.

For natural, effortless interaction it seems that well designed keys are still a good solution for human-device interaction. But there are certain design rules to follow:

- The number of keys should be low to conserve space.
- Best possible use should be made out of those few keys, and they should be located in ergonomically sound places. This means that most, if not all of the keys may have several different functions, depending on context.
- The user must always know what each key does in the current situation. Functions of the keys must be visible.

Traditional softkeys are in a way following these rules: they are context-sensitive, multi-functional keys, and there are labels on screen describing the current function of the keys. So should we simply have more softkeys on the interface? Maybe, but we must then also solve for instance how not to scatter function labels all over the actual screen content.

2. DYNAMIC PREVIEWS

2.1 Function preview

One interaction concept to try is to display the current function of a key only when the user touches the key – before the key is pressed. This allows the complete screen area to be used for the actual content whenever the user is not actively controlling the device. The preview appears temporarily on top of the content when user touches a key. We call such function indication a *function preview*, as it appears before the function is executed.

This kind of function preview requires a mechanism for sensing the presence of a finger on a key, a separate event from a key press. It can be implemented for example with a capacitive sensor beneath the keypad.

One potential use case for this is a video player application. It is naturally desirable to display the video on full screen, with no controls or other UI elements distracting the visual experience. But when the user wants to adjust volume or interrupt the playback, there must be an intuitive way to do it. A function preview can handle this situation efficiently. Figure 1 illustrates a situation where the user has set a thumb on the five-way navigation key. The viewer is in full-screen mode, but the functions of the five-way key are displayed on top of the image while a finger is sensed. If the user presses a key, the function is executed and the preview graphic is highlighted as a feedback. If

the finger is taken away, the preview graphics disappear and nothing else happens.



Figure 1. Function preview graphics on screen when a finger is resting on the navigation key.

Function previews can be applied to softkeys in the same manner: instead of displaying softkey labels continuously, they could be displayed only when a finger touches one of the softkeys, thus freeing parts of the screen for content. In principle, with this technology all the keys in a device could act as softkeys.

A drawback of this concept is that in order to see all the available functions the user must move over several keys in the interface. The efficiency of this interface increases with experience.

2.2 Text input preview

The preview display can be applied to text input as well. In this case the preview graphic can be a character displayed right at the insertion point (cursor location) in the text input field. E.g. a different color can be used to distinguish the preview among all text.

Assumed benefits of this concept are:

- The user can see when the finger is on the intended key – this can be otherwise difficult with tiny keys.
- The current input mode (uppercase, lowercase, number...) of the keypad is displayed in a natural way – you see exactly what will be produced from the key.

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- The user can keep looking at the insertion point, there's no need to look at the keypad once the character locations are becoming familiar. This makes a kind of touch typing possible with a tiny keypad.
- It allows typing foreign alphabets or special characters that would not be printable in the physical keys due to lack of space.

3. DISPLAYS WITHIN KEYS

A display can also be integrated into a key/keypad for indicating the current function at all times. There are already commercial implementations using various technologies that allow two or more different symbols being displayed on a control key or surface. One example is a mobile phone with an interactive navigation keypad. [1] A PC keyboard with individual and configurable OLED displays on each key is on the market. This keyboard is fully user-configurable. [2]

Such solutions fulfill the above-mentioned requirements of flexible functionality and no sacrificed screen space. However, complicated and costly implementation can be an obstacle. Getting the user's attention on an individual key might also be difficult, as the user most of the time looks at the screen, and also since the user's hand is obscuring the keypad.

4. CONCLUSIONS & SUMMARY

Table 2. A summary of advantages and disadvantages of certain interactive technologies.

Technology	Pros	Cons
Dynamic previews for HW keys	- dynamic use of keys - dedicated screen space not needed	- function visible only when key is touched
Display integrated in keypad	- dynamic use of keys - relevant functions always visible	- visibility: user's hand may obscure the keys - construction challenges
Touch screen	- dynamic use of screen space for interface elements	- interface elements use screen space - tactile feedback problematic

So far we have not prototyped and tested the dynamic preview principles presented here. These may be new ways of using otherwise known technologies resulting in improved user experience and efficiency. We find this an interesting area of study which deserves its share among other research of mobile experiences.

5. REFERENCES

- [1] Samsung U900 Soul mobile phone video demo <http://www.youtube.com/watch?v=eROS7Ka5YjM>
- [2] Optimus Maximus keyboard project blog: http://community.livejournal.com/optimus_project