Design Your Calc

V1.1

Introduction

The human interfaces are more and more functional, easy to use and visually attractive. Manufacturers and vendors like Apple with the Mac and now the iPhone/iPad has encouraged the emergence of these interfaces.

In modern interfaces, we can already set many elements:

- the apparence to satisfy the taste differences in colours,
- the presence or absence of buttons to accommodate the principal use,
- pallets by function in order to not overload the main window,
- etc.

However, these interfaces are still very rigid and we must all, whatever our culture, "bend" to the layout designed by the developer and / or the ergonomist to satisfy the greatest number of users.

These interfaces do not take into account differences in perceptions of space and motricity of users.

A great user interface is based on the way people think and work, not on the capabilities of the device they use. Why not give to the user the capability to tell to the device the way he wants to work?

Why introduce new elements of setting?

With "multi touch" interface the user action on the controls is more direct. The hands carry and orient the tablet, the fingers pick the controls. No object mediator such as mouse and keyboard between the user and the tool.

This new relationship makes that the position and size of these control elements (button, menu, ..) and display (field text, image, ...) on the screen become more important.

Importance of the position of the controller

Position of the tablet

If you use for a long time a touch screen in vertical orientation you could get pain in arm when you get pain in neck when you must tilt your head down to watch the touch screen into horizontal orientation.

Each user according to its morphology and its working environment chooses the least stressful position for his body.

> **We have to take into account the position chosen by the user to locate the controls and displays.**

Reading Interface

The direction of writing and reading of our native language greatly influences our perception of space.

When the eye travels an image, usually it sweeps from left to right and from top to bottom several diagonals and route the two main diagonals of the image. This is the reading of latin alphabet languages.

The Japanese reading direction is from right to left and from top to bottom. Some Western publishers have reproduced this reading direction in manga books by respect for the work. Which may introduce some inconsistencies because word reading is then in the opposite direction to that of the boxes (which is not the case in Japan).

The controls and display shall be located to facilitate "reading" and understanding of the interface.

Muti-touch vs mono selector

Observe how you use an application on an iPad.

Your 2 hands can pick up and orient the tablet and each of their fingers can be used to tap a control. With a computer only the single finger of one hand (those who manipulate the mouse) can point and click a control.

The multi-touch allows multiple selections of controls.

The multi-touch requires a special gesture and a good coordination of the fingers of two hands.

This facility must provide the timeliness if we place the controls in suitable areas.

The controls shall be placed to facilitate coordination of the fingers of two hands.

Command area and display area

With “multi-touch” interface when the finger touches the screen, you cannot see what's underneath.

To prevent the selection of a control element hides the display element is necessary to define two distinct zones: one for control elements, one for display elements.

The size of the display element must also be variable to adapt to eyesight.

The selection of a control should not hide a display element.

The importance of size

Area Selection:

The selection of an object is no longer the pixel at the end of the mouse pointer but the centre of the surface pressure of the finger. This surface is also not always the fingertip but why not his side for the thumb of the griping hand for example.

It is difficult to tap a control element whose surface is smaller than the area of selection (fingertip). The size of the controls must take account of such use.

The multi-touch interface introduces zoom to facilitate access control elements (buttons and links) of web pages but not in application windows.

Depending on the shape of their hand, the mobility of their fingers, the users will not use the same surface of their fingers to apply pressure on the screen to select the same control.

Some people use the thumb, some other the forefinger. Some people use the fingertip while other uses the side of the finger.

Everyone should be able to adapt the interface of the application to the gesture he considers most effective for himself.

> **The size of a control element should be similar to the size of the selection surface.**

Size according to frequency of use of the control:

All control elements are not used with equal frequency. An item used frequently should be larger in order to facilitate its selection.

> **The size of an element of control must be based on its level of use.**

User eyesight:

Depending on the quality of our eyesight (with or without glasses) we all have optimum distance to watch and read a book, a screen. By the direct relationship between the hands and the screen "mutli-touch" interface gives us the maximum distance. This corresponds to the length of our arms.

Each user adjusts that distance for the optical focusing to avoid eyestrain.

Of course more little is the object to read, more this distance should be reduced.

Change the size of the controls and display to adapt the interface to the eyesight.

Summary

The goal is to make the interface more adaptable to the "mobility", the eyesight and perception of space of each user. In one word to make the interface more comfortable for everyone.

A few rules to take in account:

1. Separate the display area and control area to avoid hiding the display elements during the selection of a control element,
2. Separating the control area into 2 zones one for each hand,
    a. The coverage area of the less agile griping hand is composed of large elements in smaller number,
3. To locate the control elements in the control area, consider:
    a. the orientation of the tablet (vertical, horizontal)
    b. the griping by the user (right, left)
    c. the reading direction of the user (left to right, right to left)
    d. the gesture chosen by the user,
4. To size each control element, consider the frequency of use and the finger chosen to tap it,
5. To size each display element, consider the distance of clear vision.

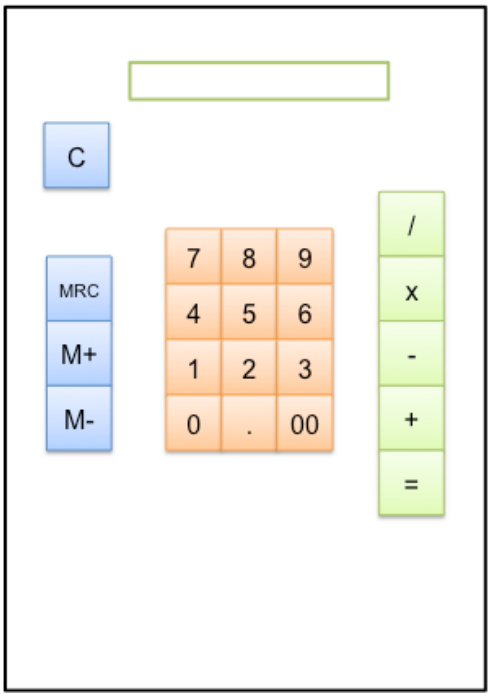
Illustration

To illustrate this concept, here is a calculator application which you can move and resize the display and number, operation and memory management keys.

Standard layout

The standard layout of buttons of a calculator is:

- number buttons in a centred square shape from "0" at the bottom left to "9" in the upper right
- operation buttons on the right,
- memory buttons on the left,
- display at the top of screen.



Is this layout the result of an ergonomic study or the repetition of a pattern that has proven itself? Or is it rather a layout that optimizes surface area and thus reduces production costs of the final product. In any case the result is that each user has to adapt to this layout.

Note that in an interface multi-touch surface available is imposed and that these considerations to optimize production costs are not to be taken into account. But the capability to optimize the user's gestures may be decisive in his choice.

Regarding the layout of numbers keys it should be noted that it differs completely from the computer, telephones and mobiles keyboards. One benefit of the capability to set the position and size of these keys would be to standardize keyboard configuration.

In the use of a calculator, the keystroke to repeat is: [number (s), [operation, number (s), "=" sign], memory (s)]

The most used key is the sign "=".

Number keys and operator keys must be close to reduce the gesture.

Obviously the number of new layout is very large. For simplicity let us take the example of a reading direction from left to right and top to bottom and a griping by the left hand.

Variants corresponding to the other senses of reading or other modes of griping can be deduced from the original by a vertical symmetry.

Examples of layouts:

Layout N1

Let us apply the rules defined above:

Separation of display areas and control:

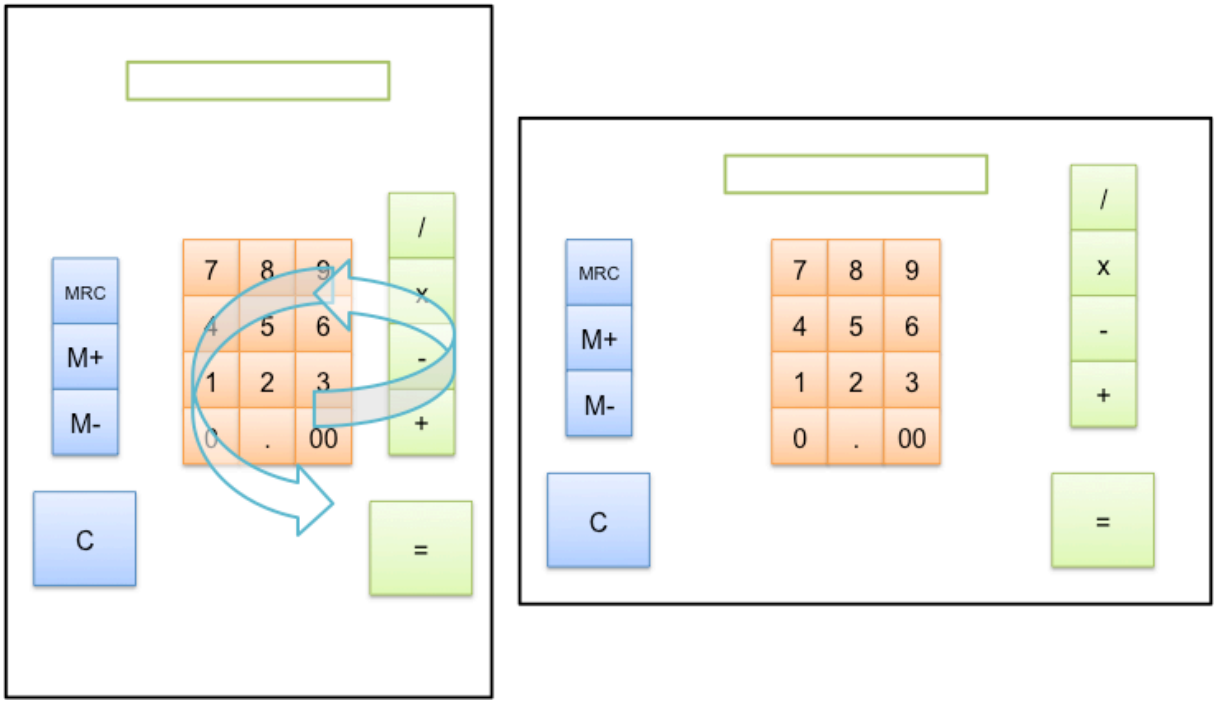
- Display area at the top of the screen
- Control area at the bottom.

Display Area

- Centred above the number keys

Control area

- Operator buttons on the right selected by the fingers of right hand
    - The button "=" is larger than because of its frequency of selection than other operation keys.
- Number buttons in a centred square shape selected by the fingers of right hand
- Memory buttons on the left selected by the fingers of left hand gripping the tablet,
- The Clear button is larger than other due to its frequency usage.



Layout N2

Separation of display and control areas:

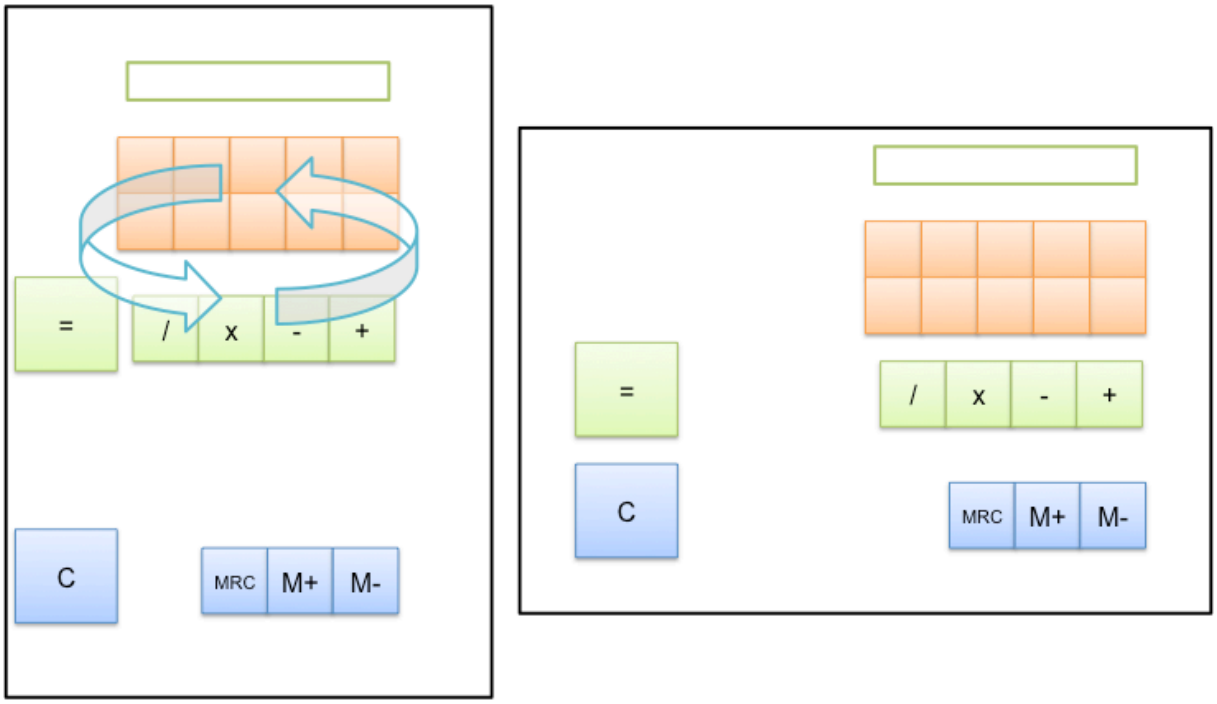
- Display area at the top of the screen
- Control area down

Display Area

- Above number keys

Control area

- Number buttons below the display in 2 rows selected by the fingers of right hand
- Operation buttons below selected by the fingers of right hand
    - The button "=" is larger than other because of its selection frequency. It can be selected by the thumb of the left hand
- Memory buttons below selected by the fingers of right hand
- The Clear button is larger than other because of its selection frequency. It can be selected by the thumb of the left hand



Note that the horizontal layout is not a simple transformation of the vertical one and the keys "=" and "C" are placed near the left edge to be selected by the thumb of the gripping left hand.

Layout N3

Separation of display areas and control:

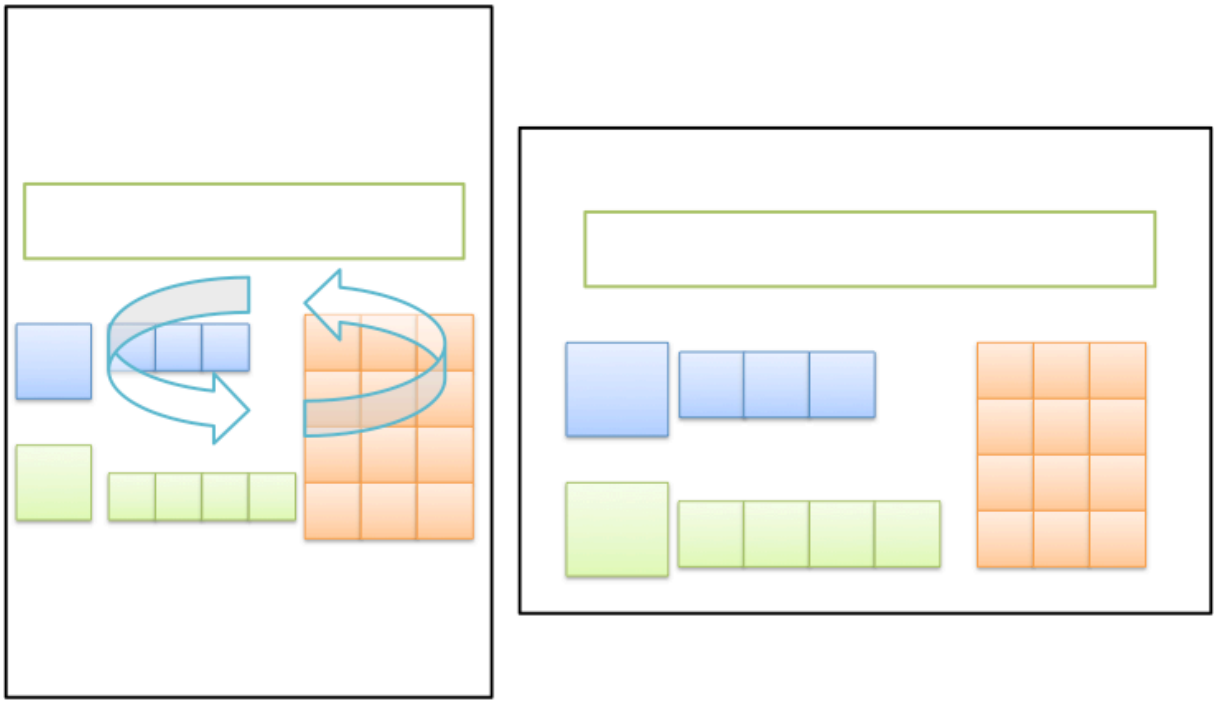
- Display area at the top of the screen
- Control area down

Display Area

- Above number keys on the screen width

Command area

- Number buttons on the right selected by the fingers of right hand
- Operation buttons on the left selected by the fingers of right hand
    - The button "=" is larger than other because of its selection frequency. It can be selected by the thumb of the left hand
- Memory buttons below selected by the fingers of right hand
- The Clear button is larger than other because of its selection frequency. It can be selected by the thumb of the left hand



Layout N4

Separation of display areas and control:

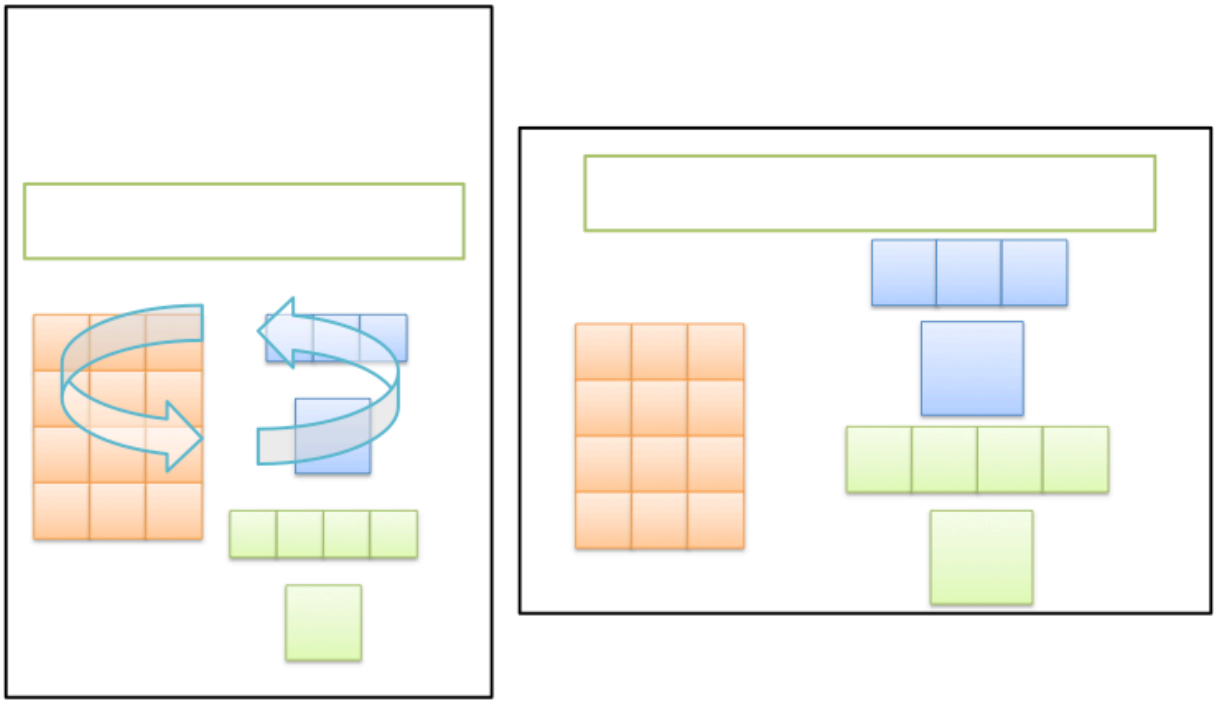
- Display area at the top of the screen
- Control area down

Display Area

- Above the buttons on the screen width

Command area

- Number buttons on the left digit selected by the fingers of right hand
- Operation buttons on the right selected by the fingers of right hand
    - The button "=" is larger than other because of its selection frequency.
- Memory buttons below selected by the fingers of right hand
- The Clear button is larger than other due to its selection frequency.



In this layout the left hand only serves to grip the tablet.

Layout N5

Separation of display areas and control:

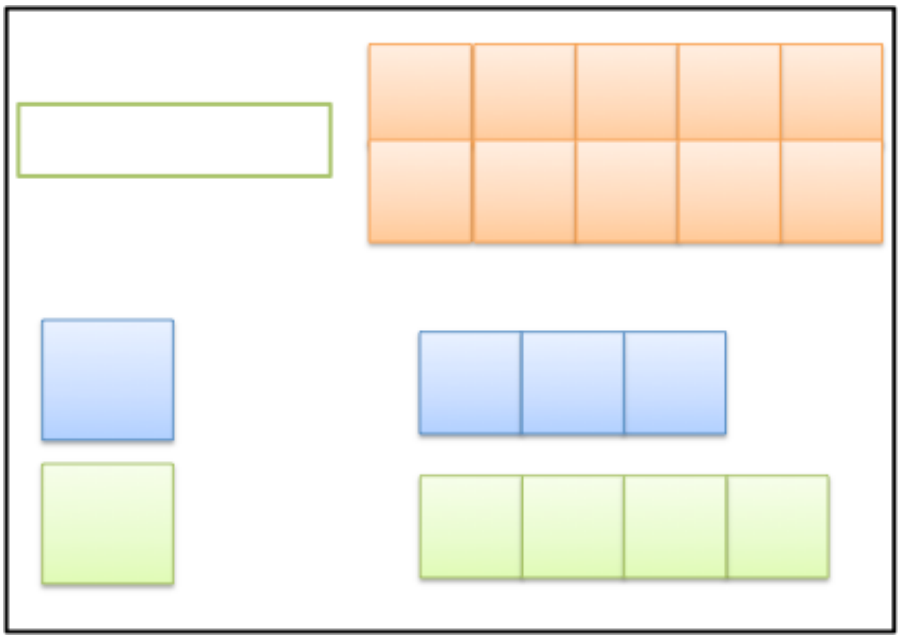
- Display area to the left
- Control area on the right

Display Area

- Left figures

Control area

- Number buttons on the right selected by the fingers of right hand
- Operation buttons below selected by the fingers of right hand
    - The button "=" is larger than other because of its selection frequency. It can be selected by the thumb of the left hand
- Memory buttons below selected by the fingers of right hand
- The Clear button is larger than other because of its selection frequency. It can be selected by the thumb of the left hand



Note that this layout cannot be used in a vertical orientation.

Implementation

In the interface development it is necessary to provide new control elements to implement functions for:

- Validate / invalidate the moving / resizing of controls and display.
- Save the settings in the user preferences for each orientation,
- Restore the original configuration.

We must also add the processing of the recognition of gestures representing the movement / resizing of the controls and display.

Conclusion

If you are a user we hope you enjoy testing some layouts to find the most comfortable for your usage.

If you are an app developer we hope you agree with this new vision and you put some position and size setting in your next app.

How to use it?

If you want to set your own layout just tap the top left button: 

Then the application turns in authorized moving mode and you can change location and size of each element of the interface. This invalidates the strokes tap.
To change size of element you have to pinch open or close. To change locations just drag the element.

By a touch and hold on each keystroke a local menu with item “Reset” is displayed. This will give its original size.

When this is finished just tap this button to save your setting. 

Two more buttons are available:

 to reset the initial layout,

 to change the style of the interface: three styles are provided for now: black, color and metal.

Then to return in normal usage of the calculator just taps on this button. This invalidates the elements moving and sizing. 

Thanks

https://developer.apple.com/devcenter/ios/index.action

http://www.techotopia.com/index.php/IPhone_App_Development_Essentials