# Improving Touch Based Gesture Interfaces

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## ABSTRACT
The lack of affordance in gesture interfaces make interaction non-intuitive and time has to be invested in learning the various gestures. This can be difficult for first-time users. The Visual Gestures on Maps (VGMaps) mobile application was developed to test if the inclusion of visual cues improves the efficiency and intuitiveness of touch-based gestures. User testing showed that visual cues made no difference with regards to the basic touch gestures, such as swiping and flicking, but an improvement was noted with more advanced gestures (multi-touch zoom).

## Categories and Subject Descriptors
H.5.2 – [Information Interfaces and Presentation]: ***User Interfaces*** *- Interaction styles (e.g., commands, menus, forms, direct manipulation).*

## General Terms
Information Systems, Human Computer Interaction (HCI)

## Keywords
Information Interfaces and Presentation, Gesture Recognition

## 1. INTRODUCTION
Devices that use touch interfaces have become ubiquitous, especially with the advent of the smart phone [6]. Other input methods, such as using the keyboard or keypad (mobile), have design features which aid users in how they should be used (e.g., buttons afford to be pressed). Touch-based gesture interfaces fail in this respect as the touch surface offers no clues as to which gestures enable interaction [1].

The development of different interfaces and devices has caused non-standard design patterns and user interaction methods. The same gestures typically perform different actions in different situations. Swiping to the left in a photo management application will bring up the previous photo, where the same action in a map application will move the map. These factors cause an increase in the time that it takes to learn and recall the gestures in order to use the device properly.

Even though different techniques are used (see section 2) to improve the efficiency and intuitiveness of touch-based gestures, the addition of visual cues to an application and its effect to a user's experience will be investigated.

## 2. RELATED WORK
There are different strategies that describe how gesture interfaces can be improved by either standardisation of the gestures itself or by changing the way that gestures are taught and introduced to first time users.

Certain special interest groups have investigated trying to standardise the current array of gestures and providing a forum for designers and researchers to discuss the possibilities of improving touch-based interfaces [2].

For novice users, learning the set of gestures requires an investment of time. Gesture Play [3] aims to teach novice users these gestures by making the learning of gestures fun.

The Touch Gesture Reference Guide [4] acts as a point of reference for designers in developing touch-based user interfaces. These static images depict the basic gestures for most touch commands across the different devices and platforms.

## 3. PROBLEM STATEMENT
Standardisation of touch gestures in order to improve touch-based interfaces will take a significant amount of time, as designers, researchers, usability professionals and device manufacturers have to reach a consensus. Users often choose recognition over recall by preferring to use a GUI alternative rather than learning the gestures [3].

In order to improve the recognition of certain touch gestures for first time users, visual cues, such as static images and those seen in the Touch Gesture Reference Guide [4], can be added to the mobile application's interface. The purpose of the static

images is to explain/depict the movements that are required to complete a certain gesture.

The aim therefore is to test if the inclusion of these static images will improve the efficiency and intuitiveness of touch gestures.

## 4. SYSTEM DESIGN

The system must accommodate the core touch gestures such as drag/swipe and flick. It must also include some advanced touch gestures. The pinch to zoom multi-touch gesture was selected for this purpose.

A Map application was developed for a device running Android 2.3.4. This type of application encompasses all of the basic touch gestures that were needed. The application has two modes: a normal mode and a mode with visual cues enabled.

The Google Maps API for Android [5] external library was used to create the basic map application. The Google Maps API adds mapping capabilities and handles the downloading, rendering and caching of map tiles.

Disabling the standard control buttons (zoom etc.) that the Google Maps API provides is necessary to enforce the use of gestures instead of tapping buttons. This standard map application, with no overlays, forms the normal mode of operation.

### 4.1 Visual Gestures

The visual images for the required gestures will consist of static images that are placed on a static overlay on the side of the map. It acts only as a reference and not as a means of interaction; therefore the images should not resemble buttons.

The static images use hands; movement arrows and a small word description in order to depict the gesture (see Fig. 1).

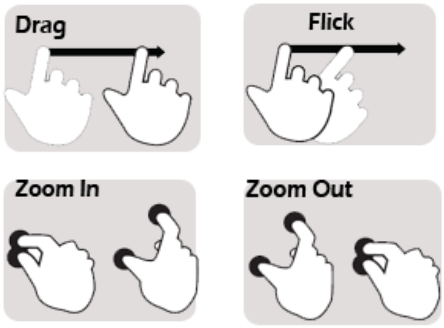


***Figure 1: The Static Visual Cues***

On starting the application a prompt requests the user to enable or disable visual gestures. If the visual gesture icons are enabled, the icons are placed on a transparent overlay (see Fig. 2).

## 5. USER STUDY

In order to evaluate the effect that the gesture icons have, basic tasks need to be performed by novice or first time users.

Users were divided into two groups but all of the users were required to perform the same tasks. One group had visual gestures enabled while the other group had visual gestures disabled. This allowed drawing conclusions about the difference between the two modes.


***Figure 2: Map with Visual Gestures enabled***

### 5.1 Visual Gestures on Maps

Before interaction with the application a mode was chosen at random. This ensured that half of all the users had visual cues enabled and the other half had visual cues disabled.

Users were asked to complete the following simple tasks:

1. To move the map in any direction (Left, Right, Up, Diagonally…)
2. To use a multi-touch gesture to zoom in to and to zoom out of the map.
3. To flick (a horizontal movement of the finger) in order to move the map at a faster rate.

### 5.2 Participants

Twenty-two volunteers took part in the user study. Fourteen (63%) participants were first time users of a touch device while the rest stated that they had used touch sensitive devices a few times before but still considered themselves novice users.

### 5.3 Experimental Design

The evaluation started with users being placed in one of the two groups by means of random allocation. The application then prompted for visual gestures to be enabled or disabled. The option was set as per allocation. The users where observed closely while they carried out the tasks on the device. After the tasks were completed a questionnaire capturing the subjective user preferences was filled out (see appendix 1).

The application was run on a high-end smart phone (HTC Sensation Z710e) with Android version 2.3.4. The device has a 4.3-inch (109mm) touch screen.

### 5.4 Hypothesis

Basic touch gestures have been designed in a way that makes interaction fairly 'normal'. More advanced touch gestures are slightly different as the learning curve is steeper and novice users will have difficulty interacting with the system at the beginning. Taking this into account the following hypothesis should be tested:

Visual cues will improve the recognition of different gestures which will make it easier for users to complete the tasks.

### 5.5 Objective Results

Observation during the user study consisted of checking whether or not a user could perform a certain gesture. If a user could perform the task but only after a few tries it was considered a "Delayed Completion".

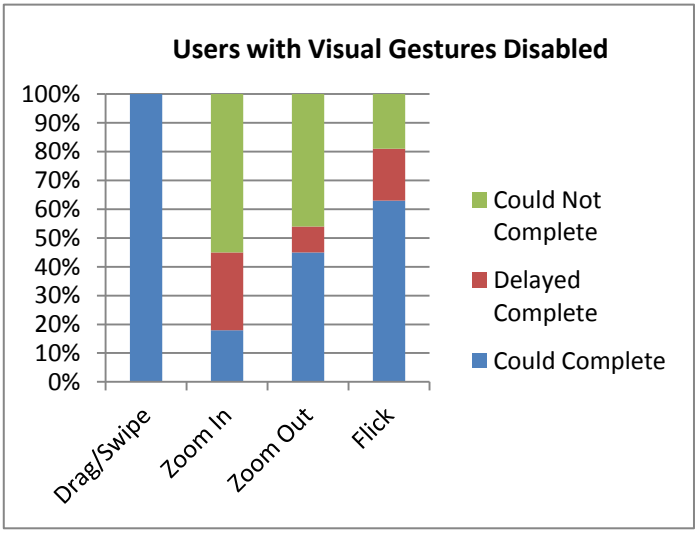


***Figure 3: Graph of percentage users who could complete tasks with visual gestures disabled.***

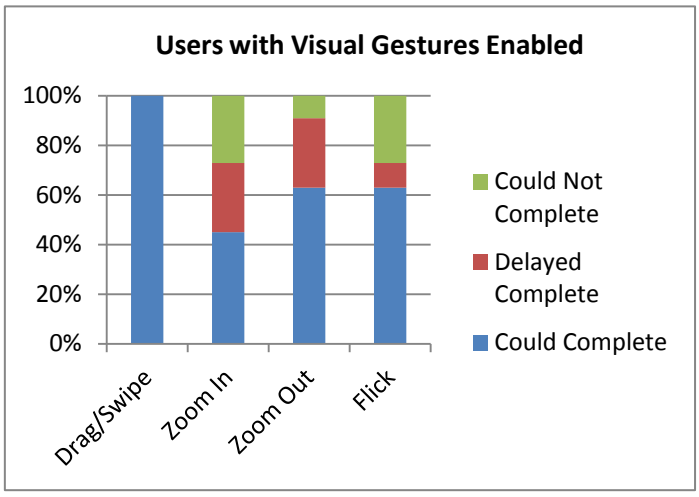


***Figure 4: Graph of percentage users who could complete tasks with visual gestures enabled.***

The basic touch gestures such as dragging and flicking had no notable change between the two different modes. All of the users could perform the dragging/swiping gestures regardless of the icons being on or off. The flicking gesture had a 63% completion for both users with visual gestures on and off.

The multi-touch 'zooming in' gesture had 27% more users completing the task with icons on than users with icons off. The 'zooming out' gesture had 18% more users, with icons on, complete the task. An average of 70% of the users who had icons disabled could complete all of the tasks (including delayed completion) whereas users with icons enabled had an average of 84% completion.

The hypothesis can thus be accepted as the participants with visual gestures enabled (figure 3) had more users complete tasks than those with visual gestures disabled (figure 2).

### 5.6 Subjective User Preferences

In order to determine which gesture icons had more of an impact on the users, a post-evaluation questionnaire was used. The questionnaire depicted the four gesture icons that where included in the evaluation for users who had visual gestures on. The questionnaire was only given to those users who had visual gestures on.

The icon that was referenced the most was the 'Zoom In' – gesture as all of the users stated that

they looked at the icon before attempting to perform the gesture (see Figure5).

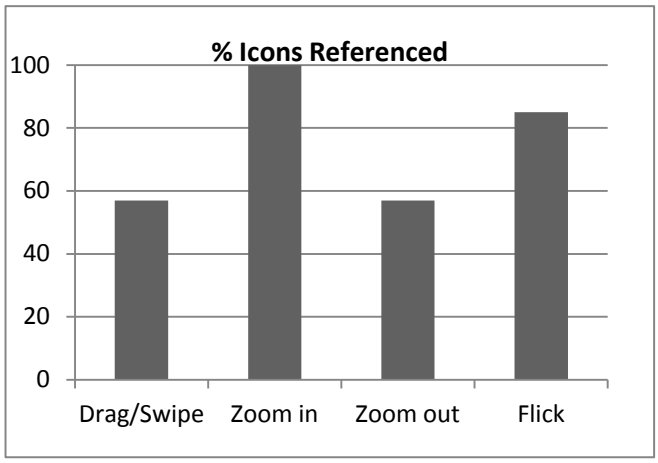


***Figure 5: Percentage of Icons Referenced by users who had visual gestures enabled***

## 6. CONCLUSION

The Visual Gestures on Maps application user study proved that the inclusion of visual cues has no effect on the basic touch gestures (swiping and flicking) as these gestures are sufficiently natural and intuitive. However, visual cues do contribute to the recognition of more advanced (complicated) gestures, such as multi-touch zoom. The visual gesture icons increased the amount of users who were able to perform the gestures successfully.

## 7. FUTURE WORK

The application of these findings should be tested on dynamic icons, which will appear according to the user's interaction with the interface (e.g. when a user places two fingers on the screen the icons for all the possible gestures will appear).

## 8. REFERENCES

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# Appendix 1

## Questionnaire

Improving Touch Based Gesture Interfaces

Please fill in the following Questionnaire as accurately as possible:

**Personal Information:**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Name: | | | | Surname: | | | | | |
| Address: | | | | City: | | | | | |
| Tel: | (H) | | | | | | | | |
| Date of Birth | ___/___/_____ | | | Gender: | | M | | F | |
| Ethnicity: | | Black | | White | | Coloured | | Indian | |
| | | Asian | | Other | | Prefer not to say | | | |
| Highest Year in School Completed | Grade: | | | University/College Year: | | | | | |
| | Standard: | | | Prefer not to say | | | | | |
| | | | | | | | | | |

Please rate you previous experience with touch devices by ticking the appropriate box:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Never used it before | | Used it once before | | Used it a few times | | Use it a lot |

**Rate how you experienced the following tasks:**

Dragging the map around (left, right, up, down, diagonal):

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | It was very easy to complete | | Easy to complete | | Eventually figured out how to complete | | Did not know how to complete |

Zooming in:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | It was very easy to complete | | Easy to complete | | Eventually figured out how to complete | | Did not know how to complete |

Zooming Out:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | It was very easy to complete | | Easy to complete | | Eventually figured out how to complete | | Did not know how to complete |

Flicking:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | It was very easy to complete | | Easy to complete | | Eventually figured out how to complete | | Did not know how to complete |

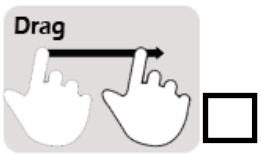
(turn page)

Answer this only if you had Visual Gesture Icons **enabled**:

How helpful were the Visual Gesture Icons?

| | Very helpful | | Most icons were helpful | | One of the icons was helpful | | Did not need them |
|---|---|---|---|---|---|---|---|

Which Gesture Icons did you look at in order to make the Gestures and complete the tasks? Tick the boxes:



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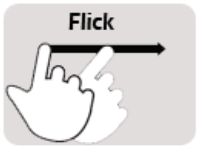

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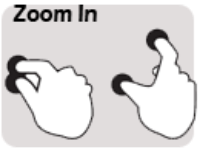

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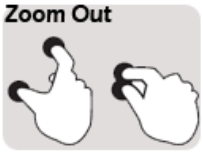

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Please list any problems you had while completing the tasks:

What was your overall experience of using the application?

Thank You for participating in this Research Study. The information provided by you in this questionnaire will be used for research purposes. It will not be used in a manner which allows identification of your individual responses.

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By signing below and returning this form, I am consenting that this data may be used in the Improving Touch Based Gesture Interfaces Research Study.

Participant name (please print): _____

Signature: _____

Date: _____