
TwelvePixels: Drawing & Creativity on a Mobile Phone

Ivan Poupyrev

Sony Computer Science Laboratories, Inc.
Higashigotanda 3-14-13, Shinagawa-ku
Tokyo 141-0022, Japan
ivan@csl.sony.co.jp

Karl D.D. Willis

The University of Tsukuba
Tennodai 1-1-1, Tsukuba
Ibaraki-ken 305-8577, Japan
karl@darcy.co.nz

Website: www.12pixels.com

Abstract

TwelvePixels is an interface for drawing pixel-based imagery using only the standard keys on the mobile phone handset. Using an essentially simple drawing method, an extensive range of imagery can be created and shared between users. This paper explores the rationale and details behind the development of the *TwelvePixels* interface; tracking possible applications for promoting creativity, communication, and content sharing on mobile phones.

Keywords

Mobile phone interfaces, drawing, creativity, art, participatory, social computing, input techniques.

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): User Interfaces: Input devices and strategies, Theory and methods.

Introduction

Recently there has been a significant shift in media creation from 'top down' publishing to 'bottom up' creation and distribution on the internet. Popular websites such as Wikipedia, YouTube, Flickr, and others rely almost entirely on content created and uploaded by thousands of internet users worldwide. This relatively recent phenomena, often described as 'user generated content', was first investigate by Henry Jenkins in what he termed participatory culture: 'a culture with

Copyright is held by the author/owner(s).
CHI 2008, April 5–10, 2008, Florence, Italy.
ACM 978-1-60558-012-8/08/04.

relatively low barriers to artistic expression and civic engagement, strong support for creating and sharing one's creations ... [6]'.

Jenkins' observations about participatory culture were made in relation to television and fan culture, prior to the widespread adoption of the internet [5]. Since then the rapid proliferation of the internet has driven the phenomena of participatory culture and triggered huge interest in forms of creative expression and sharing online. Teenagers in particular are drawn to participatory forms of online interaction. A 2005 study conducted by the Pew Internet and American Life project [9] concluded that over half of teenage internet users in the USA could be considered media creators. Developing and understanding new tools that facilitate creative expression is therefore becoming an increasingly important area of HCI research and practice.

Despite the growing interest in participatory culture, recent studies have shown that overall time spent with media in the home has not changed significantly for young people since 1999 [12], and in fact has shown slight declines in 2007 [13]. Tools for creative expression compete with a large variety of traditional media, e.g. television and computer games, for an increasingly smaller slice of a users free time. Our work thus focuses on mobile phones as an emerging platform for creative tools.

Mobile phones have become the one truly ubiquitous device, with already thirty countries exceeding 100% uptake [14]. In highly urban areas such as Tokyo, long periods are spent with mobile phones while commuting to and from work, a 2005 survey calculated the average one-way commute time to be an astonishing 67 minutes for workers and 72 minutes for students [4]. Our interest lies in developing tools and applications that empower users to create on the train

to and from work, while waiting for friends, or in any other in-between times.



Figure 1. Drawing with *TwelvePixels* on a mobile phone.

Despite the popularity and ever increasing capabilities of the mobile phone, application development has focused for the most part on games, online content, and voice/data communication. We are unaware of any previous attempts to design, develop, and investigate interfaces that allow users to create imagery or simply draw on a mobile phone (Figure 1). Investigating and establishing the mobile phone as a creative platform was a major motivation behind the *TwelvePixels* project. In this paper we present designs, rationale, and informal evaluation of the *TwelvePixels* interface.

Background and Related Work

Despite the limited functionality of the mobile phone, recent years have seen a growing interest in mobile creativity and content creation. Numerous mobile photography and film festivals now call for submissions, mobile blogs are growing in popularity, and at least one

(^_^*) /
 (-_-) zzz...
 \ (^ ^) /
 ('-'*) フフ
 \ (o`皿' o) /

Figure 2. Japanese style emoticons.

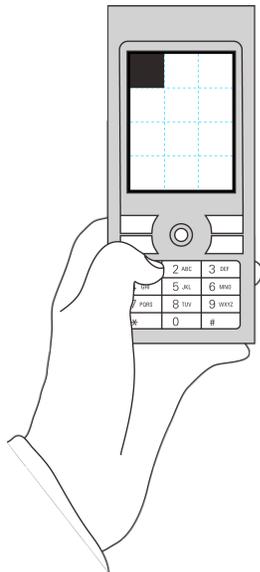


Figure 3. The *TwelvePixels* interface, keys are spatially mapped to pixels on screen.

person has gone so far as to author a novel on his mobile phone while commuting to and from work [3].

Creating pictorial compositions from text characters has been one very popular method used to express emotion and personalise e-mail or SMS messages. 'Emoticons' or 'smileys' have progressed from simple faces to increasingly complex and elaborate designs, with numerous combinations expressing a wide range of emotion (Figure 2). These mini designs have become an essential part of text-based communication for Japanese teenagers, with a predefined set almost always provided on the phone itself. Drawing on the popularity of emoticons, modern mobile phones also provide a set of graphical emoticons as an extension of the standard symbol set. However the design of these special characters can not be modified, meaning text-based emoticons remain popular and continue to evolve.

Editing of photographs taken on a mobile phone is yet another approach to provide the user with tools for creative expression. A number of mobile phones, such as the Sony Ericsson k800i, provide simple tools that allow the application of filters, text, and clipart to an image. However these filters and clipart are built into the handset and can not be modified by the user, significantly limiting the creative possibilities of working with the photograph. *TinyMotion* [7] utilises a mobile phone camera and computer vision algorithms to allow users to write letters in the air that can then be translated into text characters. *Mobile Brush* [8] is a simple application that allows the creation of 'slitscan' imagery on a mobile phone. Functioning much like a conventional scanner, *Mobile Brush* captures a vertical line of pixels over time to create an image.

The conventional mobile phone user interface is obviously not well suited for drawing, and at present we are unaware of any previous attempts to implement

drawing capabilities. Mobile devices incorporating a stylus or touch screen can provide such functionality, but remain far from ubiquitous at present. Moreover we see our goal as not to replicate existing interfaces on the mobile phone, but rather to develop new techniques that are uniquely suited and native to the phone itself. There in turn remains the possibility to develop a new style of imagery and expression that is unmistakably unique to the mobile phone.

***TwelvePixels*: Drawing on a Mobile Phone**

TwelvePixels aims to develop an elemental drawing interface to create imagery from scratch on the current generation of mobile phones. The interface is based on the fundamental idea that each of the twelve keys on the conventional mobile phone can be mapped on to one of twelve 'pixels' onscreen. The 'pixel' in our interface however, is not a screen pixel but instead a section (or cell) of the drawing area that mirrors the three by four grid of the keypad. Each cell corresponds to a button on the mobile phone keypad. When the user presses the '1' key on the top-left of the keypad, the cell in the top-left of the drawing area is triggered on or off (Figure 3). The spatial relationship between the input device and the on-line interface is immediately apparent. Toggling each cell on and off is as simple as pressing the same keypad key again.

Spatially linking physical buttons to onscreen interface elements has been used to some degree in existing mobile phone menus and also explored in the *SmartPad* [11] and *PreSense* [10] interaction techniques for selection of on-screen elements such as menus and buttons. *TwelvePixels* differs from this previous work in that it expands the metaphor into a drawing interface and moreover introduces 'levels' that allow incrementally smaller cells to be marked out. As the user presses a dedicated key, the drawing area shrinks down a level and can be repositioned onscreen with the

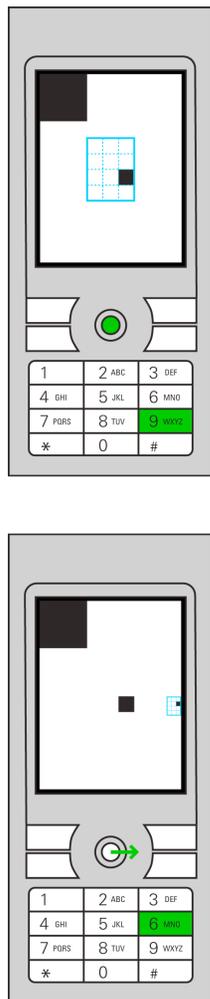


Figure 4. By moving down levels and positioning the drawing area, more detailed imagery can be created.

directional keys (Figure 4). Using the keypad the user can then mark out smaller sized cells onscreen to create imagery at a finer scale. Currently up to three levels have been implemented, along with functionality to allow the entire drawing area of that level to be filled with colour.

There are several benefits that the *TwelvePixels* interaction technique can potentially provide. Firstly, similar to other projects within the field of embodied interaction [1] we have attempted to take advantage of strong tactile cues that the physical mobile phone keypad provides. At any moment the user can find and press relevant keys to mark out pixels onscreen, relying only on tactile feedback. This is especially important for mobile users as they need to repeatedly shift their attention from the mobile phone to the surrounding environment. Secondly, in designing the *TwelvePixels* interface we attempted to minimise the number of key presses required when drawing. At any moment the user can select from twelve neighbouring pixels without needing to reposition the drawing area.

To avoid the complexities of an onscreen user interface, we have utilised the ability of the mobile phone to handle multiple key presses. Shades of grey can be created by holding down a modifier key then pressing a keypad key until an appropriate colour is selected. Lines can also be created by holding down a keypad key, then pressing the directional keys to move in any direction. *TwelvePixels* attempts to keep interaction with the drawing as direct as possible by utilising key combinations that do not break away from the drawing screen to deal with colour or mode selection.

In creating *TwelvePixels* we strived to develop an interface that could be used almost immediately with minimal time spent learning it. Much like using pen and paper we wanted *TwelvePixels* to be immediately comprehensible, enabling the user to start drawing

right away by simply making marks on screen. Further features of the interface, such as using modifier keys to control shades of grey, could then subsequently be learnt while drawing.

Various functionality was implemented at different stages in the development of *TwelvePixels*, including the addition of colour, point to point line drawing, and increased resolution. However we found that by increasing the resolution, the drawing area became too small to be functional. Likewise adding other features such as a colour picker, impacted upon the simplicity of the interaction. By keeping to a minimal 27 x 36 pixel canvas and 5 shades of grey we hoped users could quickly and satisfyingly create imagery within the set of predefined rules; not having to worry about the more intimidating aspects of beginning a drawing. We are currently investigating ways to introduce more advanced drawing functionality without compromising the simplicity and directness of the interface.

User Observations: How People Draw

TwelvePixels was debuted to the public at an exhibition attended by several hundred people. A simple web-based sharing application was created which allowed visitors to upload their drawings for others to see. Over the course of two days, drawings created by visitors to the exhibition demonstrated that despite its simplicity, *TwelvePixels* permits for a very wide range of creative responses (Figure 5).

Although how people went about drawing varied greatly, several common drawing characteristics emerged when using *TwelvePixels*. The ability to colour large areas of the screen meant that users often drew using both additive and subtractive methods, adding white pixels to a black background or subtracting white pixels from a white area. As shown in the top left image of Figure 5, a user can quickly construct a face by filling a large area with white colour then marking out the

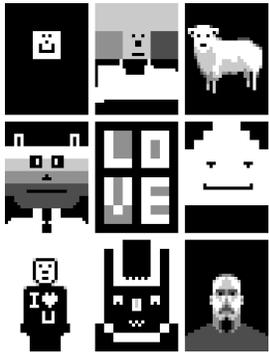


Figure 5. Imagery created by visitors to the exhibition.

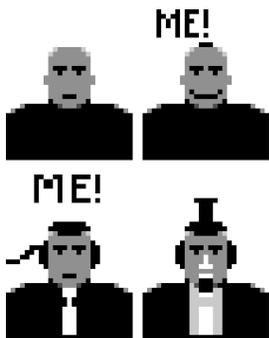


Figure 6. Imagery is remixed over time using the *TwelvePixels* image sharing feature.

eyes, nose, and mouth with smaller black pixels. As opposed to traditional drawing, where the artist adds colour to the canvas, this approach is more akin to sculpting with clay or play-doh. Users can quickly block out key elements before adding further detail, with the drawings themselves reflecting this process with strong composition and contrast.

Another notable characteristic emerged with the addition of a simple sharing interface allowing users to browse, open, and edit existing drawings. As shown in Figure 6, a face drawn by one user would be loaded as a starting point and subsequently changed by the next user. This system saved users from having to start from a blank canvas and meant they could also contribute by remixing an existing work. As has been shown with collaborative online drawing systems such as Andy Deck's *Glyphiti* [2], multiple user interaction adds a further dimension to the work created and can potentially have a positive influence on the creative process.

These observations are merely a starting point before expanded user studies, formal experiments, and evaluations are carried out on the *TwelvePixels* interface.

Applications

TwelvePixels is a generic interaction technique for drawing on mobile phones that can be applied in numerous ways. Potential applications can roughly be divided into two major areas: *personalisation* of the mobile phone experience and the *sharing* of imagery in a network-based setting.

Applications for *personalisation* would allow users to customise their mobile phone by creating unique desktop images and user interface elements, decorate their text messages and email with custom icons and emoticons, and annotate/amend photos taken on their

mobile phone camera. In combination with location-based services on mobile phones, user created imagery would allow the creation of location specific icons and personal avatars.

Sharing and network-based social interactions would allow users to create, remix, and share imagery as part of a web community, or contribute to a multi-user drawing system. Users can also upload their personal drawings online and exchange them with other users.

The *TwelvePixels* interaction technique can also accommodate a range of other applications and hardware platforms. A simple example we have implemented allows users to draw ASCII-art style images using symbols and emoticons. Users toggle icons on and off to create a design embedded into a standard email. Albeit a very simple idea, such functionality allows for a further degree of creativity when communicating via email (Figure 7).



Figure 7. The *TwelvePixels* interface.

Conclusions and Future Work

TwelvePixels is part of our broader efforts to investigate the use of mobile phones as a creative platform for expressing oneself through imagery, music, animation, and other creative arts. Our goal is to explore what could be achieved if we re-thought the role of the mobile phone as a device for creative expression as well as communication.

TwelvePixels is one solution that attempts to establish both basic interface tools for drawing on a mobile phone, and channels through which social interaction and exchange can take place. Despite the inherent restrictions of the mobile phone interface itself, in the context of participatory culture the field of mobile creativity is a promising area of HCI research and just beginning to be explored. With more mobile phones per capita, more hours spent commuting, and less time spent with media at home, the marriage of mobility and creativity makes sense.

References

- [1] Beverly, L.H., Kenneth, P.F., Anuj, G., Carlos, M. and Roy, W. Squeeze me, hold me, tilt me! An exploration of manipulative user interfaces. *Proc. SIGCHI Human factors in computing systems* (1998).
- [2] Deck, A. *Glyphiti*. Collaborative online drawing system. 2001. <http://artcontext.org/glyphiti/>
- [3] Elkington, N. Commuter writes book using mobile phone. *Reuters*, 2007.
- [4] Foreign Press Center Japan. *Facts and Figures of Japan - Housing*. 2005.
- [5] Jenkins, H. *Textual Poachers: Television Fans & Participatory Culture*, *Studies in culture and communication*. Routledge, New York, 1992.
- [6] Jenkins, H. *Confronting the Challenges of Participatory Culture*, The MacArthur Foundation, Chicago, 2006.
- [7] Jingtao, W. and John, C. TinyMotion: camera phone based interaction methods. *Ext. Abstracts CHI 2006*, ACM Press (2006).
- [8] Lam, K.Y.K. *Mobile Brush*, 2007. http://www.the-demos.com/?page_id=116
- [9] Lenhart, A. and Madden, M. *Teen Content Creators and Consumers*. Pew Internet and American Life, 2005.
- [10] Rekimoto, J., Ishizawa, T., Schwesig, C. and Oba, H. PreSense: interaction techniques for finger sensing input devices. *Proc. User interface software and technology*, ACM Press (2003).
- [11] Rekimoto, J., Oba, H. and Ishizawa, T. SmartPad: a finger-sensing keypad for mobile interaction. *Ext. Abstracts CHI 2003*, ACM Press (2003).
- [12] Rideout, V., Roberts, D.F. and Foehr, U.G. *Generation M: Media in the Lives of 8-18 Year-olds*. A Kaiser Family Foundation Study, 2005.
- [13] Veronis Suhler Stevenson *VSS Communications Industry Forecast 2007-2011*. 2007.
- [14] Wallace, B. 30 Countries Passed 100% Mobile Phone Penetration in Q1. *Telecommunications Online*, 2006.