m-LoCoS UI: A Universal Visible Language for Global Mobile Communication

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Abstract. The LoCoS universal visible language developed by the graphic/sign designer Yukio Ota in Japan in 1964 may serve as a usable, useful, and appealing basis for a mobile phone applications that can provide capabilities for communication among people who do not share a spoken language. User-interface design issues including display and input are discussed in conjunction with prototype screens showing the use of LoCoS for a mobile phone.

Keywords: design, interface, language, LoCoS, mobile, phone, user.

1 Introduction

1.1 Universal Visible Languages

Over the centuries, many different theorists and designers have been interested in and proposed artificial, universal sign or visible languages intended for easy learning and use by people all over the world, a kind of visual Esperanto. For example, in the last century, C.K. Bliss in Australia, invented Blissymbolics, [1] a language of signs, and attempted to convince the United Nations to declare Blissymbolics a world auxiliary visible language. Likewise, the graphic designer and sign designer Yukio Ota introduced in 1964 his own version of a universal sign language called LoCoS [5, 6, 7], which stands for Lovers Communication System. The LoCoS language, invented in 1964, was published in a Japanese LoCoS reference book in 1973 [5]. Ota has presented lectures about LoCoS around the world since he designed the signs, and published several articles in English explaining his design, *e.g.*, [6]. The author has written about Ota's work [3], and the author's firm maintains an extranet about LoCoS at this URL: http://www.amanda.com/extranet/extranet_f.html (username: locos, *note: all lowercase*, password: yuki00ta, *note: contains zeros, not o's).* One of the significant features of LoCoS is that it can be learned in one day. Participants at Ota's lectures have been able to write him messages after hearing about the system and learning the basics of its vocabulary and grammar.

Based on this background, the author's firm worked with Mr. Ota over a period of several months in 2005, and in the ensuing months since then, to design prototypes of how LoCoS could be used on a mobile device. This paper presents an introduction to LoCoS, the design issues presented by trying to adapt LoCoS to a mobile phone use,

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an initial set of prototype screens, and future design challenges. The author and Associates of the author's firm worked with the inventor of LoCoS in early 2005 and subsequently to adapt the language to the context of mobile device use.

1.2 Basics of LoCoS

LoCoS is an artificial, non-verbal, generally non-spoken, visible language system designed for use by any human being to communicate with others who may not share spoken or written natural languages. Individual signs may be combined to form expressions and sentences in somewhat linear arrangements, as shown in Figure 1.

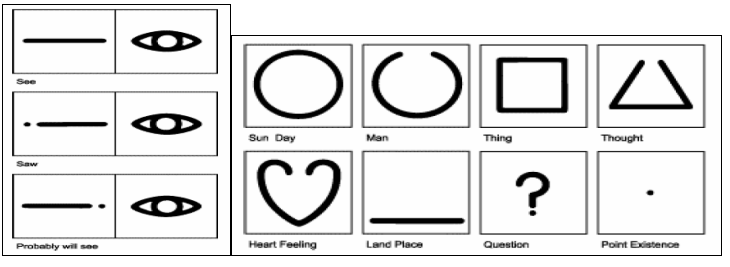

Fig. 1. Individual and combined signs

The signs may be combined into complete LoCoS expressions or sentences, formed by three horizontal rows of square area typically reading from left to right. Note this culture/localization issue: Many, but not all symbols could be flipped left to right for readers/writers used to right-to-left verbal languages. The main contents of a sentence are placed in the center row. Signs in the top and bottom rows act as adverbs and adjectives, respectively. Looking ahead to the possible use of LoCoS in mobile devices with limited space for sign display, a mobile-oriented version of LoCoS can use only one line. The grammar of the signs is similar to English (subject-verb-object). This aspect of the language, also, is an issue for those users used to other paradigms from natural verbal languages.

LoCoS differs from alphabetic natural languages in that the semantic reference (sometimes called "meaning") and the visual form are closely related. LoCoS differs from some other visible languages, *e.g.*, Bliss symbols use more abstract symbols, while LoCoS signs are more iconic. LoCoS is similar to, but different from Chinese ideograms, like those incorporated into Japanese Kanji signs. LoCoS is less abstract in that symbols of concrete objects like a road sign shows pictures of those objects. Like Chinese signs or Kanji, one sign refers to one concept, although there are compound concepts. According to Ota, LoCoS re-uses signs more efficiently than traditional Chinese signs. Note that the rules of LoCoS did not result from careful analysis across major world languages for phonetic efficiency. LoCoS does have rules for pronunciation (rarely used), but audio input/out was not explored in the project to be described for a mobile-LoCoS.

LoCoS has several benefits that would make it potentially usable, useful, and appealing as a sign language displayable on mobile devices. First, it is easy to learn in a progressive manner, starting with just a few basics. The learning curve is not steep,

and users can guess correctly at new signs. Second, it is easy to display; the signs are relatively simple. Third, it is robust. People can understand the sense of the language without knowing all signs. Fourth, the language is suitable for mass media and the general public. People may find it challenging, appealing, mysterious, and fun.

2 Design Approaches for m-LoCoS

2.1 Universal Visible Messaging

m-LoCoS could be used in a universal visual messaging application, as opposed to text messaging. People who do not speak the same language can communicate with each other. People who need to interact via a UI (UI) that has *not* been localized to their own language normally would find the experience daunting. People who speak the same language but want to communicate in a fresh new medium may find LoCoS especially appealing, *e.g.*, teen-agers and children. People who may have some speech or accessibility issues may find m-LoCoS especially useful.

Currently the author's firm has developed initial prototype screens showing how LoCoS could be used in mobile devices. The HTML prototype screens have been developed showing a Motorola V505 and a Nokia 7610 phone. A LoCoS-English dictionary was begun and is in progress. Future needs including expanding LoCoS, exploring new, different visual attributes for the signs of LoCoS , including color, animation, and non-linear arrangements (called LoCoS 2.0), and developing the prototype more completely so that it is more complete and interactive.

The assumptions and objectives for m-LoCoS include the following:

For the developing world, there is remarkable growth in the use of mobile phones. China has over 300 million phones, larger than the USA population, and India is growing rapidly. People seem to be willing to spend up to 10% of their income for phones and service, which is often their only like to the world at large. For many users, the mobile phone is the first one that they have ever used. In addition, literacy levels are low, especially familiarity with computer user-interfaces. Thus, if mobile voice communication is expensive and unreliable, mobile messaging may be slower but cheaper, and more reliable Texting may be preferred to voice communication in some social settings. m-LoCoS may make it easier for people in developing countries to communicate with each other and with those abroad. The fact that LoCoS can be learned in one day makes it an appealing choice.

In the industrialized world, young people (*e.g.*, ages 2-25) have a high aptitude for learning new languages and user-interface paradigms. It is a much-published phenomenon that young people like to text-message, in addition to, and sometimes in preference to talking on their mobile phones. In Japan, additional signs, called emoticons have been popular for years. In fact, newspaper accounts chronicle the rise of *gyaru-moji* ("girl-signs") , a "secret" texting language of symbols improvised by Japanese teenage girls. They are a mixture of Japanese syllables, numbers, mathematical symbols , and Greek characters. Even though gyaru-moji takes twice as long for input as standard Japanese, they are still popular. This phenomenon suggests that young people might enjoy sign-messaging using LoCoS. The signs might be unlike anything they have used before, they would be easy to learn, they would be

expressive, and they would be aesthetically pleasing. A mobil-device-enabled LoCoS might offer a fresh new way to send messages.

2.2 User Profiles, and Use Scenarios

Regarding users and their use-context, although 1 billion people use mobile phones now, there are a next 1 billion people, many in developing countries, who have never used any phone before. A mobile phone's entire user interface (UI) could be displayed in LoCoS, not only for messaging but for all applications, including voice. For younger users interested in a "cool" or "secret" form of communication in the industrialized world, they would be veteran mobile phone users. LoCoS would be an add-on application, and the success of *gyaru-moji* in Japan, as well as emoticon-use, suggests that a m-LoCoS could be successful. Finally, one could consider the case of travelers in countries that do not speak the traveler's language. Bearing in mind these circumstances, the author's firm developed three representative user profiles and use scenarios for exploring m-LoCoS applications and its UI. Use Scenario 1 concerns the micro-office in a less-developed country: Srini is a man in a small town in India. User Scenario 2 concerns young lovers in a developed country: Jack and Jill, boyfriend and girlfriend, in the USA. Use Scenario 3 concerns a traveler in a foreign country: Jaako is a Finnish tourist in a restaurant in France. Each of these is described briefly below.

Use Scenario 1: Micro-office in a less-developed country. Srini in India lives in a remote village that does not have running water, but just started having access to a new wireless network. The network is not reliable or affordable enough for long voice-conversations, but is adequate for text-messaging. Srini's mobile phone is the only means for non-face-to-face communication with his business partners. Srini's typical communication topic is this: should he go to a next village to sell his products, or wait for the prices to rise?

Use Scenario 2: Young lovers in the USA. Jack and Jill, boyfriend and girl friend, text-message each other frequently, using 5-10 words per message, and 2-3 messages per conversation thread. They think text-messaging is "cool," *i.e.*, highly desirable. They think it would be even "cooler" to send text messages in a private, personal, or secret language not familiar to most people looking over their shoulders or somehow intercepting their messages.

Use Scenario 3: Tourist in a foreign country. Jaako, a Finnish tourist ina restaurant in Paris, France, is trying to communicate with the waiter; however, he and the waiter do not speak a common language. A typical restaurant dialogue would be: "May I sit here?" "Would you like to start with an appetizer?" "I'm sorry; we ran out of that." "Do you have lamb?" All communication takes place via a single LoCoS-enabled device. Jaako and the waiter take turns reading and replying, using LoCoS.

2.3 Design Implications and Design Challenges

The design implications for developing m-LoCoS are that the language must be simple and unambiguous, input must occur quickly and reliably, and several dozen m-LoCoS signs must fit onto one mobile-device screen. Another challenge is that LoCoS as a system of signs must be extended for everyday use. Currently, there are

about 1000 signs, as noted in the guidebook published in Japanese [5]. However, these signs are not sufficient for many common use scenarios. The author, working with his firm's associates, estimate that about 3000 signs are required, which is similar to Basic Chinese. The new signs to be added cannot be arbitrary, but should follow the current patterns of LoCoS and be appropriate for modern contexts a half-century after its invention. Even supposedly universal, timeless sign systems like those of Otto Neurath's group's invention called Isotypes [3,7] featured some signs that almost a century later are hard to interpret, like a small triangular shape representing sugar, based on a familiar commercial pyramical paper packaging of individual sugar portions in Europe in the early part of the twentieth century.

Another design challenge for m-LoCoS is that the mobile phone UI itself should utilize LoCoS (optionally, like language switching). For the user in developing countries, it might be the case that telecom manufacturers and service providers might not have localized, or localized well, the UI to the specific users' preferred language. M-LoCoS would enable the user to comfortably rely on a language for the controls and for help. For users in more developed countries, the "cool" factor or the interest in LoCoS would make a m-LoCoS UI desirable. Figure 3 shows an initial sketch by the author's firm for the some signs.

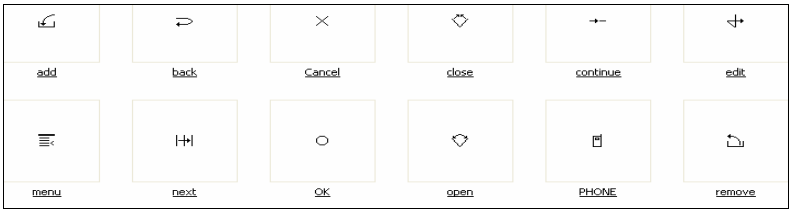

Fig. 2. Sketch of user-interface control signs based on LoCoS

Not only must the repertoire of the current LoCoS signs be extended, but the existing signs must be revised to update them, as mentioned earlier in relation to Isotype. Despite Ota's best efforts, some of the signs are culturally or religiously biased. Of course, it is difficult to make signs that are clear to everyone in the world and are pleasing to everyone. What is needed is a practical compromise that achieves tested success with the cultures of the target users. Examples of current challenges are shown in Figure 4. The current LoCoS sign for "restaurant" might often be mistaken for a "bar" because of the wine glass sign inside of the building sign. The cross as a sign for "religion" might not be understood correctly, thought appropriate, or even be welcome in Moslem countries such as Indonesia.

Another challenge would be to enable and encourage users to try LoCoS. Target users must be convinced to try to learn the visible language in one day. Non-English speakers might need to accommodate themselves to the English subject-verb-object structure. In contrast, in Japanese, the verb comes last, as it does in German dependent phrases. Despite Ota's best efforts, some expressions can be ambiguous. Therefore, there seems to be a need for dictionary support, preferably on the mobile device itself. Users should be able to ask, "what is the LoCoS sign for the X, if any?, or "what does this LoCoS sign mean?"

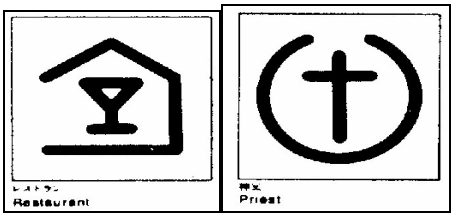

Fig. 4. LoCoS signs for Priest and Restaurant

In general, displaying m-LoCoS on small screens is a fundamental challenge. There are design trade-offs among the dimensions of legibility, readability, and density of signs. Immediately, one must ask, what should be the dimensions in pixels of a sign? Figure 5 shows some comparative sketches of small signs.

Japanese phones and Websites often seem to use 13 x 13 pixels. In discussions between the author's firm and Yukio Ota, it was decided to use 15 x 15 pixels for the signs. This density is the same as smaller, more numerous English signs. There was some discussions about whether signs should be anti-aliased; unfortunately, not enough was known about support of mobile devices with grayscale pixels to know what to recommend. Are signs easier to recognize and understand if anti-aliased? This issue is a topic for future user research.

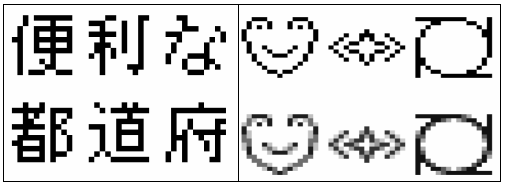

Fig. 5. Examples of signs drawn with and without anti-aliasing

2.4 Classifying, Selecting, and Entering Signs

There are several issues related to how users can enter m-LoCoS signs quickly and reliably. Users may not know for sure what the signs look like. What the user has in mind might not be in the vocabulary yet, or might not ever become a convention. One solution t is to select a sign from a list (menu), the technique used in millions of Japanese mobile phones. Here, an issue is how to locate one of 3,000 signs by means of a matrix of 36 signs that may be displayed in a typical 128 x 128 pixel screen (or a larger number of signs in the larger displays of many current high-end phones).

The current prototype developed by the author's firm uses a two-level hierarchy to organize the signs. Each sign is in of 18 domains of subject matter. Each domein's list of signs is accessible with 2-3 key strokes. 3000 signs divided into 18 domains would yield approximately 170 signs per domain, which could by shown in five screens of 36 signs each. A three-level hierarchy might also be considered. As with many issues, these would have to be user-tested carefully to determine optimum design trade-offs. Figure 6 shows a sample display.

Fig. 6. Sample prototype display of a symbol menu for a dictionary

To navigate among a screen-full of signs to a desired one, numerical keys can be used for eight-direction movement from a central position at the 5-key, which also acts as a Select key. For cases in which signs do not fit onto one screen (*i.e.*, more than 36 signs), the 0-key might be used to scroll upward or downward with one or two taps. There are challenges with strict hierarchical navigation. It seems very difficult to make intuitive the taxonomy of all concepts in a language. Users may have to learn which concept is in which category. Shortcuts may help for frequently-used signs.

In addition, there are different (complementary) taxonomies. Form taxonomies could group signs that look similar (*e.g.*, those containing a circle). Properties taxonomies could group signs that are concrete *vs.* abstract, artificial *vs.* natural, micro-scaled *vs.* macro-scaled, *etc.* Schemas (domains in the current prototype) would group "apple" and "frying pan" in the same domain because both are in the "food/eating" schema.

Most objects/concepts belong to several independent (orthogonal) hierarchies. Might it not be better to be able to select from several? This challenge is similar to multi-faceted navigation in mobile p hones. It is also similar to the "20 Questions" game, but would require fewer questions because users can choose from up to one dozen answers each, not just two choices. Software should sort hierarchies presented to users by most granular to more general "chunking." It is also possible to navigate two hierarchies with just one key press.

A realistic, practical solutions would incorporate context-sensitive guessing of what sign the user is likely to use next. The algorithm could be based on the context of a sentence or phrase the user is assembling, or on what signs/patterns the user frequently selects. Figure 7 illustrates multiple categories selection scheme.

	Concrete	Abstract	Don't know
Man-Made	1	2	3
Naturally -Occurring	4	5	6
Both	7	8	9
Don't Know	*	0	#

Fig. 7. Possible combinations of schema choices for signs

If the phone has a camera, like most recent phones, the user could always write signs on paper and send that image-capture to a distant person or show the paper to a

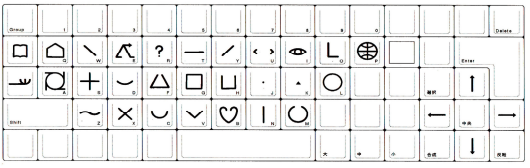

Fig. 8. LoCoS keyboard designed by Yukio Ota

person nearby. However, the user might still require and benefit from a dictionary (in both directions of translation) to assist in assembling the correct signs for a message.

There are other alternatives to navigate-and-select paradigms. For example, the user could actually draw the signs, much like Palm® Graffiti ™, but this would require a mobile device with a touch screen (as earlier PDAs and the Apple iPhone and its competitors provide). One could construct each sign by combining, rotating, and resizing approximately 16 basic shapes. Ota has also suggested another, more traditional approach, the LoCoS keyboard, but this direction was not pursued. The keyboard is illustrated in Figure 8.

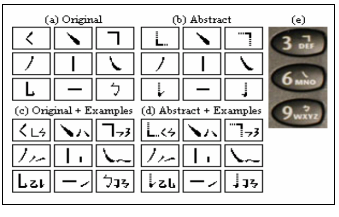

Fig. 9. examples of stroke-order sequential selection from [2]

Still another alternative is the Motorola iTAP® technique, which uses stroke-order sequential selection. In recent years, there have been approximately 320m Chinese phones, with 90m using text messaging in 2003, using sign input via either Pinyin or iTAP. m-LoCoS might be able to use sequential selection, or a mixed stroke/semantic method. Figure 9 shows examples of stroke-order sign usage for Chinese input.

2.5 Future Challenges

Beyond the matters described above, there are other challenges to secure a successful design and implementation of m-LoCoS on mobile devices that would enable visible language communication among disparate, geographically distant users.

For example, the infrastructure challenges are daunting, but seem surmountable. One would need to establish protocols for encoding and transmitting LoCoS over wireless networks. In conjunction, one would need to secure interest and support from telecom hardware manufacturers and mobile communication services.

3 Conclusion: Current and Future Prototypes

The author's firm, with the assistance and cooperation of Yukio Ota, investigated the design issues and designed prototype screens for m-LoCoS in early 2005, with subsequent adjustments since that time. About 1000 signs were assumed for LoCoS, which is not quite sufficient to converse for modern, urban, and technical situations. There is a need for a larger community of users and contributors of new signs. The current prototype is a set of designed screens that have been transmitted as images and show the commercial viability of LoCoS. Figure 10 shows a sample screen.

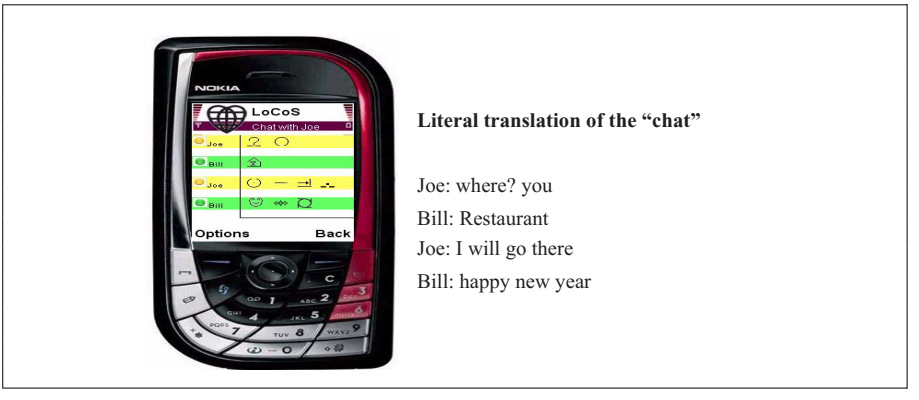

Fig. 10. Example of a prototype chat screen with m-LoCoS on a mobile phone

Among next steps contemplated for the development of m-LoCoS are to develop an online community for interested students, teachers, and users of LoCoS. For this reason, the author's firm designed and implemented an extranet about LoCoS at the URL cited earlier. In addition, new sign designs to extend the sign set and to update the existing one, ideal taxonomies of the language, working interactive implementations on mobile devices from multiple manufactures, and the resolution of technical and business issues mentioned previously lie ahead. Of special interest to the design community is research into LoCoS 2.0, which is currently underway through Yukio Ota and colleagues in Japan. The author's firm has also consulted with Mr. Ota on these design isues: alternative two-dimensional layouts; enhanced graphics; color of strokes, including solid colors and gradients; font-like characteristics, *e.g.*, thick-thins, serifs, cursives, italics, *etc.*; backgrounds of signs: solid colors, patterns, photos, *etc.*; animation of signs; and additional signs from other international sets, *e.g.*, vehicle transportation, operating systems, *etc.*

m-LoCoS, when implemented in an interactive prototype on a commercial mobile device would be ready for a large deployment experiment, which would provide a context to study its use and suitability for work and leisure environments. The deployment would provide, also, a situation for trying out LoCoS 2.0 enhancements. A wealth of opportunities for planning, analysis, design, and evaluation lies ahead.

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