KIWANJA.NET
MINDFUL SOCIAL CHANGE

MOBILE DATABASE · REPORT

NON-LITERACY MOBILES

Author / organisation	Nokia Research Center
Year recorded	2008
Region	Global
Category	Other
Archive page	kiwanja.net/mobile-database/non-literacy-mobiles/

This document is part of the kiwanja.net Mobile Database, an archive of more than 700 articles, reports and projects on mobile technology for development, collected between 2003 and 2010. It is reproduced here for reference; the original author's rights are retained.

Explore more. Browse the full archive at kiwanja.net/mobile-database.
Looking for support with your own social change work? See kiwanja.net/work-with-me.
Ken Banks offers coaching, mentoring and strategy support.

Navigation

Centers

Research Areas

Innovation Center

Our People

Publications

News

About Us

Events

Links

Careers

OpenSource Nokia

Research Wiki

OpenSource Wiki

Nokia Beta Labs

Forum Nokia

Home > Understanding Non-Literacy as a Barrier to Mobile Phone Communication

Understanding Non-Literacy as a Barrier to Mobile Phone Communication

Overview

- Emerging markets have higher numbers of textually non-literate people than more developed markets
- Effective use of mobile phone features requires an understanding of textual prompts
- Contact management and asynchronous communication in particular presents challenges for textually non-literate people
- Solutions can be categorized as improvements to the phone, the ecosystem and to the operator infrastructure

Keywords:
India and China user experience, user research, ethnography, device competency, illiteracy, non-literacy, numeracy, innumeracy, contact management, communication, mobile phone, product design

Introduction:

The mobile phone enables personal, convenient synchronous and asynchronous communication - in essence allowing its users communication to trascend time and space, at a time and in a context of his or her choosing. It is unsurprising therefore that with these almost superhuman characteristics many people consider their mobile phone to be one of the essential objects to carry when leaving home [1]. These benefits and associated costs apply equally to an urban city dweller in London as they do to a rural farmer in Bangladesh.

As traditional markets for mobile phones such as Sweden, U.K., and Singapore reach saturation point handset manufacturers actively seek growth in 'emerging markets' such as India, China, Vietnam, Brazil and Indonesia including some of the world's most populous countries [2]. Targetting products and services at new markets creates many new challenges, not least of which is understanding and meeting the needs of new customers.

A number of these markets have limited formal education and consequently lower levels of literacy and numeracy. The United Nations estimates the total number of illiterate adults to be 799 million worldwide, 270 million of which are located in India alone [3,4,5]. UNESCO defines illiteracy as a 'person who cannot with understanding both read and write a short simple statement on their everyday life' [6]. In this article, the author uses the term 'textually non-literate' to reflect that there are many ways to define literacy. For example, task-literacy can be the ability to complete a particular task, computer-literacy the ability to make basic use of a computer. The author acknowledges that non-literacy is not caused by lack of ability but rather by lack of opportunities for learning.

The key question for mobile phone manufacturers who wish to address the communication needs of this potential customer base is: How does the inability to read and write affect the ability of mobile phone users to make effective use of mobile phones? How can we design communication tools that draw on the knowledge and experiences that these users do have?

This article presents conclusions from a number of studies by researchers in Nokia Research Centers in Tokyo, Beijing and Helsinki in an effort to understand the communication habits of non-literate people, and how we might improve their communication experience. Please note that this research does not imply the development of products and services proposed in this article by Nokia or its partners.

The Impact of Structured vs. Unstructured Learning on Device Competency

If a mobile phone's sole purpose is to be a status symbol, then holding it up to one's ear and pretending to speak to a remote someone is enough to show off the phone and send a signal to others that you can afford to own a phone and make a call, no textual literacy is required. However the primary benefits of the mobile phone as a tool for personal and convenient synchronous and asynchronous communication, and secondary benefits such as contact management, time keeping, time planning, alarm clock can be extremely challenging for someone with limited mastery of words and numbers and their meanings.

There are many ways to learn how to use a device or complete a task. A useful distinction is to think about structured and unstructured means. Unstructured learning includes visual feedback - how it looks; observation - how it behaves and how other people interact with it in the world around them; tactile - how it feels; and aural - how it sounds. For example a person may never have picked up a mobile phone, but based on advertising and television alone would be able to ascertain the right way to orientate the device to the face. Product, industrial and user interface designers try to utilize as many of these cues as possible to make the mobile easy and logical to use. Textual and numerical literacy is typically learned through structured learning (schooling). Since the mobile phone interface includes both numbers and letters it is understandable that a degree of textual and numerical literacy is required to be able to use many of the features on the phone. This is a problem if, as in India, structured learning and consequently levels of literacy and numeracy are low.

Figure 1: Device competency as a result of structured and unstructured learning

There are a number of ways to define literacy. Whilst the U.N.'s definition for a literate person is someone who can 'with understanding, both read and write a short simple statement in his or her everyday life' [6]. The Chinese government, on the other hand, uses criteria that somewhat accounts for what is needed in that user's context - a literate person is someone from the countryside who can read 1500 Chinese characters, or 2000 Chinese characters for employees in corporations or citizens in towns and cities. The definition also covers a person's ability to carry out simple accounting [7]. There are many reasons for being non-literate including the need to forego schooling to enter the workforce to financially support the family, lack of educational infrastructure, and having being taught, but never applying what was learned. Our assumption is that everyone has the potential to become textually literate, just not the opportunity.

Whilst definitions for non-literacy can help frame the discussion, the more relevant question is - where does textual and numerical non-literacy become a barrier to device competency?

In emerging markets a user's experience will be affected by other factors. The user may be literate or semi-literate in a language that the phone user interface does not support. In India for example, many people speak languages that are not yet supported by Nokia language packs. Or the device itself may well have been bought used and is mechanically unreliable, perhaps continuously repaired by one of the many street-repair services [8]. Buttons may be worn out. Alternatively, if the network coverage is weak and oversubscribed to, multiple attempts to call must be made before a connection is made. Calls may be frequently dropped. Whilst each of these factors may not present an insurmountable inconvenience by itself, consider the difficulty in learning how to use something when the experience itself is unpredictable.

Figure 2: Learning a new interface made more difficult with a worn keypad (Hangzhou, China)

Icons - the quick fix?

At this point you may be thinking that icon-driven menus are the solution to the non-literacy problem - after all everyone can understand the meaning of a few pictures, right? Why not create an icon based mobile interface?

Whilst it is true that richer iconic support could assist a textually non-literate user, this is a long way from suggesting to design a mobile phone relying totally on an iconic interface. Icons by themselves are not the answer. For starters the meaning and subsequent use of icons are best understood when initially accompanied by textual descriptions [9]. Understanding can be improved by successfully completing tasks, which implies an understanding of the textually annotated steps that make up a task, exploration and a degree of prior device understanding. Many tasks, like configuring GPRS settings, are so abstract from the user's real-world knowledge that no amount of talented icon designers applied to the problem will be able to solve. Lastly, were icons to be designed for every phone feature they would need to be comprehensively tested with each diverse user group, perhaps requiring 100's if not 1,000's of icon variations?

Field Research to Find Answers

To explore these issues initial research was conducted in India in 2004 [10] with follow-up studies in 2005 India, China and Nepal as part of Nokia's exploration of future user interface requirements [11,12,13]. Study locations were selected because of a mixture of a high level of textually non-literate participants and research partners with suitable available skills [14].

These partners assisted with data collection, cultural interpretation and synthesis. The studies included 11 non-literate participants who were engaged in a variety of manual trades such as cook, cleaner, gas station attendant and caretaker. Data from these participants was collected using a variety of qualitative techniques: shadowing, observations, and contextual interviews, including screening criteria for literacy and numeracy. We looked at what devices our non-literate participants currently used, studied how they managed to maintain contact information, and documented their strategies for coping with written material.

Figure 3: Understanding the devices and user interfaces that participants did use (Hangzhou, China)

Figure 4: Understanding where participants came in contact with text and numbers (Hangzhou, China)

Figure 5: Contextual inquiry in the home (Hangzhou, China)

Figure 6: Exploring a public call office and other communications options (Almedabad, India)

Our aim was to understand the world from the perspective of a non-literate person. How they survived (or even thrived) in a world of words and numbers, the bottlenecks in their desire to communicate.

General observations

Our first observation is that our textually non-literate participants lead more predictable lives than more literate counterparts from other studies. There are multiple explanations for this, one being is that our textually non-literate participants had limited disposable income since they were largely only able to obtain entry level manual work which paid relatively little. Disposable income provides options increasing the range of what is on offer. The second reason can explained by thinking about the acceptable amount of effort required to complete a given task. Choosing a dish from a restaurant menu requires asking the restaurant staff or literate fellow diners what is on offer. Sometimes this is fine, but multiply this task for every time literacy is a barrier and it soon begins to grate on the person to the point where it is easier to simply make the same choices time and again. In a world of words and numbers literacy opens up a world of easier options.

Our second observation is that textually non-literate users can complete tasks requiring a degree of textual literacy, but these tasks typically take considerably longer to complete. Being asked to fill in a form at work may take a literate person five minutes - whereas for a textually non-literate person it becomes an overnight task involving the availability of a literate relative or friendly neighbour. This is sometimes called 'proximate literacy' - the ability to rely on others who either are sufficiently competent in using the device, or are literate and can take the user through the steps requiring textual understanding. For example, one participant in India sent text messages via her literate daughter and required her daughter to understand the responses. Families or even whole villages may share the use of a single mobile phone [15,16]. The obvious reason for this is the cost of ownership and use, but also because in societies where fixed line penetration is limited the mobile phone is the first phone available to them [16].

Our third observation is that there is a 'parallel universe' of cues that are visible if only you know how to see it. Bank notes are a good example in that they are required to be usable by all members of society, and provide multiple cues to their authenticity and value. While you might be thinking of print quality and watermarks, our non-literate participants picked up on texture (China) and scent (India, for 500 rupee notes) of the notes [10,11]. What additional cues can our devices offer that are not noticeable by literate users?

Figure 7: Understanding value (and whether it is counterfeit) by touch (Hangzhou, China)

Fourth - with sufficient application of intellect and memory, rote learning can be used to memorize the steps needed to carry out most tasks. However, rote learning is not understanding, and when things go wrong, understanding is often required to solve the problem. Remember that the used/shared mobile phone and network may be less reliable, and problems are more likely to arise.

Lastly, a number of our participants worked very long hours with little or no holiday time. Who has the greater need for personal, convenient synchronous and asynchronous communication? - someone working 9 to 5, 5 days a week, or someone working 5 to 9, 7 days per week? The potential benefits of a mobile for this user group should not be underestimated.

How non-literate users get by

The simple answer is that non-literate mobile phone users can call, but cannot message or use the address book. The subtleties are more interesting than this.

Two basic tasks were easy for almost all our participants to complete: turning on the phone and answering an incoming call. Beyond this, there were various degrees of success. Dialing a local phone number is relatively easy, but problems can occur when there are variations such as dialing a national or international number, or using IP telephone prefixes. Dialing an incorrect number may require starting from the beginning of the task since the cancel button is not always understood.

Our hypothesis is that once the non-literate user has learned how to make and receive phone calls to their close circle of contacts, their primary reason for owning a mobile phone has largely been met. There is, therefore, less motivation to spend additional time rote learning other features on the phone, unless someone can proactively demonstrate the worth of the features, and spends the time to teach them the steps required to complete the task.

Phone features that require text editing such as creating a contact, saving a text message, and creating a text message present too great a barrier to use.

Information is often relayed as part of a phone call, but taking a verbal message during a phone call requires the user to remember the message details since this cannot be written down. This increases the likelihood that the message will simply be that a person called, rather than the content of the message itself. It may or may not be possible to write down numbers, and names if written are often annotated with a rudimentary markings understood only to the writer. The call log served as an ad hoc address book, albeit one in which the user needs to remember the number of calls since the person they wish to communicate with last called.

Several of our participants kept paper phone books. Typically, contact information was written and updated by a literate family member, and sometimes annotated by the textually non-literate user as an aid to remembering who was who. Specific contact information was remembered based on a number of criteria including on what page in the address book it was written, what colour pen was used to write the number and position on the page. The ability to put contact information into the most appropriate format significantly supports the user's ability to gather it in one convenient place.

Figure 8: Paper address book used by textually non-literate participants (Hangzhou, China)

We noted that textually non-literate users of public call offices often took a scrap of paper with a phone number scrawled on it to the owner and asked them to dial the number. This system is open to errors caused by inaccuracy, either because the number was not clearly transcribed, or simply because the paper on which the number was written was worn and faded from being carried.

User interface designers often talk about the user's mental model of a system, and how it maps to the reality of how a device actually functions. It is typical for designers to use metaphors such as the 'desktop' or 'soft keys' to support the building of an accurate model. Textually non-literate users will not have access to textual cues, so their mental model may well be poor. Whilst a poor mental model is not a problem within a limited range of (rote learned) tasks, if and when errors occur users may adopt the wrong strategies to correct the problem. Designers use a myriad of audio, visual and textual cues to support the user's understanding of how the mobile phone works. Literate persons are able to quickly absorb (and subsequently ignore) this textual information and apply the knowledge in practice. A positive outcome reinforces their understanding of how the system works and helps build an accurate mental model. Textually non-literate people are required to make assumptions for the textual prompts based on how the device responds to their actions. A plausibly positive result is sufficient to believe that is how the system works regardless of how well it maps to the actual system.

A true community address book

Public Call Offices are widely used in India, with customers often arriving with a scrap of paper with a phone number written on it. If the customers try to dial the number themselves, it can take a long time to match the numbers on the paper with those on the phone interface, and long pauses between button presses on a fixed line phone often cause the system to time out. Not surprisingly it is common to ask the PCO owner to dial the number for their customers.

Our research noted that some PCO owners in Gujarat Province try to differentiate themselves from their competitors by offering a service where phone numbers are written down in what amounts to a address book of non-literate customers from the local community [10]. This works in two ways, firstly by writing down the number clearly the PCO owner is able to confirm the number with the customer prior to calling, and secondly it means that returning customers do not need to bring contact information with them.

At the end of the PCO call, a receipt is printed which amongst other things, includes the phone number that was dialed. We are currently exploring whether this could be the basis of an accurate non-literate address book.

PCO 'Community Address Book'

One method of learning how a device works is through trial and error. Our hypothesis is that the user's willingness to explore the user interface boils down to perceived risk versus perceived consequences. A non-literate user's willingness to explore features on a mobile phone requires weighing the perceived risk of factors such as: changing settings so that things no longer work; past experiences of things going wrong; deleting data that cannot be recovered; becoming lost and not being able to retrace steps; or physically breaking the phone. Perceived risk is not the same as actual risk. Where there are three menu options to choose from and one of them might delete the call log entries, how likely are you to use trial and error? There are individual and cultural differences in attitudes to risk and a person's perceptions of risk will change according to circumstance.

Figure 9: Much of the rich context that helps understanding is missing from the phone's user interface (Bangalore, India)

One way of thinking about the issues of context and exploration is to consider Figure 9. Let's say you are wandering around a market looking for a toilet. If you understand the signs written in one of the two languages in the picture, Hindi or English, then you can easily interpret the purpose of this building. If you are textually non-literate there is other information you can rely on: the pictures/icons of the man; asking a stranger; experimenting by following the men into the toilet (if you are male); taking a step back and observing female going into similarly pictured entrance next door. You could rely on your sense of smell, or maybe you've used this building, or one like it, before.

Now consider the issue of risk. How sure are you that this is indeed a toilet? What is the cost of making the wrong choice? Embarrassment perhaps if it turns out to be a hairdresser's or the headquarters of a local political candidate - whose mustachioed mural adorns its walls. But what if the cost is greater - for example a month's wages, or in the context of exploring a mobile phone - the cost of an expensive call, or breaking the phone - the valuable life-line to your loved ones.

Our challenge is that many mobile phone features rely on some degree of textual understanding, the tasks are that much more abstract, and the rich context is missing.

Our research team also explored alternative communication channels available for our participants, for example Public Call Offices (PCOs) in India, interviewing over 20 owners and users in an effort to understand how other communications infrastructure was used.

We identified three areas to improve the user mobile experience and, in effect, bring personal, convenient, synchronous and asynchronous communcation within the reach of textually non-literate users: on the phone; in the communications eco-system; and on the carrier network.

Improving the phone

A simple mobile phone with a minimal feature set is the short answer. In practice, this means supporting

incoming and outgoing calls with a call log adapted for use as an address book. Contact management and text messaging features could be settings that the user has to activate before they appear in the menus (a task that would require a literate person to complete). Menus could have additional iconic support [9, 11], and hardware buttons other than soft keys should as much as possible be reserved to one button for one task. A two-way rocker button can confuse and may be perceived as one button.

Wherever possible, phone settings should be automated to avoid the need for editing - for example, by default setting the time and date on the phone from the network.

Successful outcomes can be reinforced with audio feedback including for example playing back the number that was dialed prior to calling. Another option is spoken menus, though again this is a non-trivial understaking given the scale of languages and dialects to support. One radical approach could be to replace the digital contact management tool with a physical/digital hybrid that the user could annotate by pen or pencil [17].

A mobile phone equipped with a sufficiently high quality camera and display would enable the capturing and location shifting of written text, for example taking a photo of a hazardous materials sign at work and showing it to a literate relative at home. However, cost issues currently make this an unlikely mass-market solution on the lowest end phone models.

There are different ways of bringing the benefits of asynchronous communication to non-literate users through services such as Short Audio Messaging [18], or simply leaving a message on an answering machine. For all these solutions, however, accessing in-coming communication is unlikely to be a problem, compared to the complexities of saving, editing, deleting, and replying.

To avoid the social stigma associated with textual non-literacy, the phone should not be noticeably different to other products on the market.

Improving the ecosystem

The best possible solution is one that raises the population's general level of literacy and numeracy, and the mobile phone may have a role play in this regard. Beyond this - classes on how to use the phone, and creating an environment for risk-free exploration can also raise device competency levels. Low tech solutions can suffice - for example, a poster showing the flow and outcomes of keys tasks may familiarize users with the user interface to the point where they may feel comfortable to explore beyond what they already know.

It may also be possible to nurture commercial services that overcome textual barriers such as one for entering contacts into an address book and assigning photos to entries. Solutions such as this can build upon the rich social face to face interaction that already exists.

We note that IP telephony kiosks in China and PCOs in India already contain a simple printer for providing receipts, and it may be possible to hack this infrastructure to create accurate and uniformly designed contact information for textually non-literate customers.

Improving the infrastructure

Why require text entry at all? A simpler alternative to managing contacts is to press a button and then speak to an operator who connects you to whomever you want to speak to [19]. The same principal applies with messaging and managing personal information. Since Caller ID is already used as an ad-hoc relational contact management tool, why not extend the information that is sent with caller ID, including a photo and auto-build the address book? Although it would be the target of spammers and advertisers, it may be possible to auto-generate phone address book entries.

Summary

Personal, convenient, synchronous and asynchronous communication has the potential to benefit everyone. Two features of mobile phones that many users take for granted - text messaging and contact management - present significant but not insurmountable hurdles for textually non-literate users. Solutions to support these users have been proposed on the phone, in the communications ecosystem, and on the carrier network. Nokia research in this area is on-going.

Simple Non-Literacy Test

If you're wondering just how hard it is for a non-literate person to use a mobile phone? Change the language setting on your phone to one you don't understand for a day and see how well you manage.

Acknowledgements

Nokia Research Center Collaborators: Cui Yanqing, Fumiko Ichikawa, Liu Ying, Raphael Grignani, Antti Aaltonen, Mika Roykkee, Marienne Thomsen and Antti Kujala. Department of Psychology, Zhejiang University, Hangzhou: Professor Mowie Shen, Haijie Ding, Zhenyi Yang, Ying Tian. The Center for Knowledge Societies, Bangalore in particular Zeenath Hasan who at the time of writing is interning with Nokia Research Center, User Experience Group, Helsinki. Lokesh Bitra, thesis student at the National Institute of Design, Ahmedabad. John Markow, Editor Advance Magazine. And all of the participants who agreed to take part in this research. Thank-you. Portions of this article first appeared in Advance Nokia's internal research magazine, 2005 #3.

For more information

Jan Chipchase
Nokia Research Center, Tokyo
E-mail: Jan Chipchase

Jan Chipchase is Principal Researcher in the User Experience Group of Nokia Research Center. He graduated with an M.Sc. in User Interface Design from London Guildhall University, and prior to Nokia worked at the Institute for Learning and Research Technology in the UK. Jan has spent the last 5 years based in Tokyo conducting field research and developing user centered communicaton related concepts for Nokia. Issues and discussions related to Jan's research can also be found at: http://www.janchipchase.com.

All photos copyright of Nokia.

- Figure 1: Zeenath Hasan.
- Figure 2: Jan Chipchase.
- Figure 3: Understanding the devices and user interfaces that participants did use (Hangzhou, China), photo by Yang Zhenyi - Copyright Nokia.
- Figure 4: Understanding where participants came in contact with text >and numbers (Hangzhou, China), photo by Tian Ying - Copyright Nokia.
- Figure 5: Contextual inquiry in the home (Hangzhou, China), photo by Tian Ying - Copyright Nokia.
- Figure 6: Lokesh Bitra - Copyright Nokia.
- Figure 7: Understanding value (and whether it is counterfeit) by touch (Hangzhou, China), photo by Ding Haijie - Copyright Nokia.
- Figure 8: Paper address book used by textually non-literate participants (Hangzhou, China), photo by Ding Haijie - Copyright Nokia.
- (unnumbered figure): PCO Community address book: Lokesh Bitra - Copyright Nokia.

- Figure 9: Jan Chipchase.

[1] Mobile Essentials: Field Study and Concepting. November 2005, Paper accepted to Designing the User Experience 05, November 2005. Chipchase, J., Persson, P., Aarras, M., Piippo, P., & Yamamoto, T.

[2] Population in 2005: China 1.3 billion , India 1.1 billion, Indonesia 222 million, Brazil 186 million compared to UK 59 million, Sweden 9 million, Singapore 4 million. United Nations Population Division, http://esa.un.org/unpp/index.asp?panel=3

[3] Youth and Adult Literacy Rates by Country and by Gender for 2000 - 2004. Unesco Institute for Statistics (UIS), July 2004. http://www.uis.unesco.org/ev.php?URL_ID=5204&URL_DO=DO_TOPIC&URL_SECTION=201

[4] Literacy. Unesco Institute for Statistics (UIS), September 2004. http://www.uis.unesco.org/ev.php?URL_ID=4926&URL_DO=DO_TOPIC&URL_SECTION=201

[5] About Literacy Estimates and Projection Made by the UIS. Unesco Institute for Statistics (UIS), April 2004. http://www.uis.unesco.org/ev.php?ID=4930_201&ID2=DO_TOPIC

[6] UNESCO http://portal.unesco.org/education/en/ev.php-URL_ID=25075&URL_DO=DO_PRINTPAGE&URL_SECTION=201.html

[7] Chinese Government. Reference, 1993. http://www.law-lib.com/lawhtm/1993/9704.htm (Chinese language).

[8] Informal Repair Cultures, India & China, Internal Nokia Report. Jan Chipchase, 2005.

[9] The use of icons and labels in an end user application program: an emperical study of learning and retention, 1999. Susan Weidenbeck, Behaviour & Information Technology, vol. 18, no. 2.

[10] Literacy & Device Competency Report, 2004, Jan Chipchase & Zeenath Hasan. Nokia internal report.

[11] Device Competency of Non-Literate Users in China Study, 2004, Jan Chipchase & Liu Ying. Nokia internal report.

[12] Non-Literate Contact Management Exploration Study, 2004, Jan Chipchase & Fumiko Ichikawa. Nokia internal report.

[13] The author also drew on observations as a largely textually non-literate foreigner living in Japan.

[14] Given China's relatively low standing in the UNESCO illiteracy ranking why was it chosen as a site for this study? Non-literacy and non-literate participants can be found everywhere, including the major 'developed' cities such as London and Los Angeles.

[15] Understanding Societies and People in Sub-Sahara Africa. By Jokke Eljala. Nokia internal document.

[16] Mobile Phones and Development, March 10th 2005, The Economist. http://www.economist.com/research/articlesBySubject/displayStory.cfm?story_id=3739025&subjectid=894408 (subscription required).

[17] The Japanese carrier already offers a mobile phone TU_KA S manufactured by Kycocera without a display or address book. The distinctive and unfashionable design stands out. Follow links from http://www.tu-ka.co.jp (in Japanese).

[18] Short Audio Messaging - New Low Cost Voice Communication Service, November 2003. Nokia Datasheet: http://www.nokia.com/downloads/operators/downloadable/datasheets/samdatasheet_net.pdf.

[19] In this respect textually non-literate have much in common with the very rich - delegating tasks such as contact management can be a solution for almost everything.

Terms Of Use | Privacy Policy | About Us | Feedback | Copyright © 2006, 2007 Nokia. All rights reserved.