

HELSINKI UNIVERSITY OF TECHNOLOGY
Department of Computer Science and Engineering

COMEKS - THE MOBILE COMIC STRIP CREATOR

A case example in user-created content

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Abbreviations and Acronyms

J2ME	Java 2 Platform, Micro Edition; application platform for mobile devices
MMS	Multimedia Messaging Service
OS	Operating system
P2P	Peer-to-peer
S60 Platform	Platform for mobile phones that uses Symbian OS, developed primarily by Nokia
SMS	Short message service; allows sending of text messages
UCC	User-created content
UI	User interface
WAP	Wireless Application Protocol; a standard to access services with a browser on a mobile phone

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Chapter 1

Introduction

User-created content is a recently discovered area of content production which has awoken the interest of the masses and businessmen alike. New technologies have given the average users the tools to become producers of high quality content, and the Internet's peer-to-peer networks are efficiently used to distribute users' creations, thus providing an alternative to traditional producer-consumer model. However, user created content in mobile environment is still a very immature and quite unexplored field, and success stories are yet to be seen.

Modern mobile phones have finally reached the level in which they can be used to create high quality content. The inclusion of camera in mobile phones allows the users to create expressive content and share it immediately when and where things are happening; thus allowing new forms of audiovisual communication to emerge.

Moreover, mobile phones are actually portable computers which allow complex content manipulation and editing tasks performed on the phone, thus allowing users to make more interesting content. The challenge is that mobile devices' limited input capabilities make it quite difficult to produce tools which are both enjoyable to use yet allow the user to create expressive and evocative content.

This thesis describes and analyses the process of creating a content creation application for mobile users. This application, called Comeks, allows the users to create comic strips using solely a camera enabled mobile phone. It's examined as a case example of user created content, and its design process is analyzed from the concept level to final commercial product.

1.1 Project background

The Comeks project was started out as an assignment for a Helsinki University of Technology (HUT) course "T-111.007 Multimedia project" in 2004-2005. The mobile phone application developed during this project was based on an idea originating from Helsinki Institute for Information Technology's (HIIT) research program Mobile Gaming Communities (MC2). The original idea was to make a tool that allowed the user to create stories based on pre-defined templates which the user would be able to fill with photos.

The project group agreed to first refine the concept and make it more fun by allowing more freedom of creativity to the user. In the end a full-blown comic strip creator was designed, allowing as much freedom for the user as possible while being simple to use.

During the HUT project, a first menu-based version of Comeks was created, which was open sourced by HIIT to its sponsors. The core group of project team saw good business potential in Comeks concept and they decided to start a company, Bulbon Oy, which has then developed Comeks further and published a first commercial version of it.

1.2 The Comeks concept

After studying the existing mobile applications and the literature presented in chapters 2, 3 and 4, we defined the concept of Comeks. With Comeks, it should be possible to create multi-framed comic stories with comic look and feel, by creating the artwork with mobile phone's camera and adding other comic-like elements using only the mobile handset. Finally the user should be able to share the strips easily through for example MMS, web and email.

Our aim was to create an original application which would support the user in creativity and communication, while being easy and entertaining to use.

A vital part of the Comeks concept is a web community, where users could publish their creations, collaborate, discuss and socialize around comic creation. However, the web community is still under development and its design and implementation is omitted from this thesis.

1.3 Objectives of this thesis

The research presented in this thesis is multidisciplinary. The themes include computer science, usability, user experience and social studies and a little bit of comic theory. The goal is to merge and adapt information from all these areas in creating a new kind of content production tool for mobile phone users.

1. **The main objective of this thesis is to study Comeks as a case example of user-created content.**

How Comeks relates to other examples of user-created content and what can be learned from them? Demographics and users' motives in using current services are examined by studying the available literature and existing examples of user-created content. Also few general design guidelines for designing content production tools for mobile environment are given.

2. **Secondly, the development process of Comeks is analyzed from the concept level into finalized commercial product.**

The development is studied from both technological and user centered perspectives. Which technical decisions were made during the implementation and how studied literature was applied in practice? Also the creation of custom mobile user interface when the complexity of the application is high is examined. What kind of design choices and methods should be used in order to keep the application easy and enjoyable to use?

1.4 Structure of the thesis

This thesis is divided into seven chapters, which have the following contents and objectives:

Chapter 1 gives a quick introduction to the motivation of the study and introduces this thesis' objectives and its structure.

Chapter 2 introduces user-created content (UCC) to the reader by giving background information about the phenomenon. Social aspects of UCC are examined and few currently popular examples of UCC in the desktop environment are introduced.

Chapter 3 gives an overview of mobile UCC, its current possibilities and examines the social uses of mobile UCC. Also short introduction of designing content creation tools for mobile phones is given.

Chapter 4 functions as an introduction to comics, explaining the basics of comic theory. Also few modern ways of using comics and technology together are presented.

Chapter 5 analyzes the design and implementation of the Comeks application. It describes the design and technological details of the application and explains why those design choices were made.

Chapter 6 analyses the success of the work done and discusses future research topics.

Chapter 7 is the final part of the thesis; drawing the conclusions and making some final remarks.

Chapter 2

User-created content

An overview of user-created content (UCC) is presented in this chapter. A study of literature is done first and then few existing examples of UCC concepts are analyzed. This study was done in order to find out what UCC is all about, whether there is a need for comic creation application like Comeks, and what can be learned from the existing forms of UCC? These results were used together with Chapter 3's results when designing Comeks.

There are many overlapping terms trying to define the same phenomenon of user-created content. Such buzzphrases as user-generated content, two-way web, Web 2.0, social media and social networking software are also widely used to describe some parts of the same trend. The term user-created content was decided to use in this thesis, since it represents the essence of the phenomenon quite well – even though it doesn't have any indication to sociability often related to UCC.

2.1 What is user-created content?

Since the invention of printing, the industrial model of content creation has been based on the narrative domination of the broadcast media. In the model of mass media, there is a centralized producer who distributes a large quantity of identical content to a large audience. In this context, the small minority of content providers have the power to control what is made and published.[69]

The Internet possesses a threat to this system, because unlike the centralized and controlled nature of mass media, the Internet is highly decentralized, uncontrolled and peer-to-peer environment [69]. Recently, the entertainment

and media industries have finally started take advantage of these new possibilities of the Internet.

A new personal content industry is focused on selling devices and services to create personal content such as photos, videos or music [8]. We are also beginning to see a new Internet hype emerging as new start-up companies invent innovative service concepts to create and share content and socialize around it. The increasing popularity of digital cameras and camera-enabled mobile phones is encouraging to share media using these services. This is causing a shift from publisher-generated content into user-generated content, where instead of few publishers deciding what information to publish, any individual can publish what they want and make it accessible by anyone.

UCC is not new phenomenon by any means, as it has been around for years in different forms from family photography to fan productivity [53]. However, the digital publishing technologies have given the users tools to create, remix, and share content on a level that had previously only been accessible only to the professionals of broadcast, print and recorded media industry [56].

The form of user-created content is not distinct from broadcast media, but the big difference lies in the ways that content is produced, distributed [15] and consumed. These differences are explained in the following part and summarized in table 2.1.

Production of content

In the broadcast media, content is created by the experts in their area and content is usually also expert-edited, meaning that all content must pass a quality control stage where content is verified and edited by a professional editor – resulting in relatively homogenous quality of content [89]. Because of these practices, many users consider professional created content more credible and reliable [16].

User-created content on the other hand, is created by users themselves. Users can be anybody with various levels of skills and expertise, thus the resulting quality of published content is very heterogeneous [89]. Most user-created content is open to reuse by other users, in contrast to broadcast media's strict copyrights. User-created content is more likely to contain biased and incorrect information, making it less reliable source [16].

Driving force behind user-created content is often related to personal expression and interpersonal communication, rather than distribution of information, entertainment or art – as is the case with the broadcast media. [31]

Table 2.1: Differences between UCC and broadcast media

	UCC	broadcast media
production	amateurs, average users	professionals
distribution	UCC services, P2P	broadcast networks
consumption	active participation	passive reception

Distribution and consumption of content

In the mass media model, the content is broadcasted in the broadcaster owned networks (e.g. television, newspaper, or broadcaster's web page). In the UCC model, instead of consumers passively waiting to receive content produced by the media industry, the content is distributed in fluid communities of peers, connecting people sharing same interests.

In the traditional media consumption model, the viewer takes a passive role. But as seen by the recent success of many UCC sites, some users wish to be more interactive by creating, sharing and collaborating content. [31]

These users are no longer pure information consumers; instead they are information consumers, creators and active participants at the same time. The role of author becomes to co-create content with the other users. Thus, the clear boundary between producer and consumer is becoming more blurry and the consumption itself has become an act of production.

2.1.1 Social interaction and user-created content

People's natural need for social interaction is one the key factors of user-created content's current popularity. The services offering the possibility to socialize around the created content have proven to be the most popular forms of UCC.

Social interaction in UCC involves individuals interacting with the technology (i.e. usability) and with each other using the provided technology (i.e. sociability). Both of which must be taken into consideration when designing a successful UCC service and tools for using it.

The term social networking tools is used to designate the use of tools to support, extend or derive added value from social activities. Service providers usually provide a set of social tools or services that community members can use to create content and share it with the other members. These tools include for example weblogging tools, message boards, instant messaging, music and photo sharing and online social networking tools [5].

Whether it's personal communication to small group of friends or larger, more anonymous communication, these social tools can help people to communicate better. Instead of just one to many communication as in mass media model, we now also have many to many, or few to few communication.

The common characteristics of popular tools are the ease-of-use and the allowance of self-forming networks. They also encourage the reader to contribute content in various forms. Most social tools don't try to invent a new kind of content; they just make it easier what was already possible. Furthermore there is very little hierarchy compared to real world [97], as anyone can provide feedback to anybody else.

2.1.2 Advantages and disadvantages of UCC

Some, such as Rivière (cited by [51]), see mobile UCC as primarily pleasure-seeking process, which has no rational purpose, but aims at pleasing the sensations. However, Koskinen stresses that user-created multimedia may have value for the society for example in the means of making people more aware of their environment[51]. If communicating using multimedia becomes more common among average consumers, the amount of visual information grows exponentially and it's bound to have an effect on the visuality in our culture as well as to way people react to content producing acts, such as photography [54].

With the introduction of UCC, people have more specialized and more updated content that could never be possible through traditional broadcast media. The transfer of content can be immediate, without the lag in time after the occurrence of an event and when information is received.

One use for technology should be to support the creation of art and knowledge. As an example photography changed attitudes towards the art of image creation, because it enabled almost anybody to produce images rapidly at low cost. The means of information technology can be used to make creativity more common and easy. Creative people can often benefit from advanced technology to explore new domains [83]. Creating content with new technologies allows more creativity and experimentation that otherwise wouldn't be possible to many users[6].

Also, online collaboration, knowledge exchange and the act of publishing user-created content collaboratively, offers significant benefits for the society. One of the best examples of this phenomenon is the entirely free encyclopedia Wikipedia[104] which was generated by collaborating users (see section 2.2.3). These collaborative technologies can help to accelerate the distribution of

knowledge and art, therefore making them more accessible.

Even though World Wide Web has always been about sharing information openly, exchanging ideas was still limited to people with more technical skills. With the rise of these new technologies, virtually anybody can easily create their own content.

User based publishing is definitely bringing more democracy in the content we consume. Broadcast media has to create their content for the least common denominator of their large audience but when individuals start to publish their own content to niche groups, they don't have to make compromises based on their readers. Also, a large number of individuals are much more difficult to control e.g. by governments than broadcast media.

There are of course problems related with user-created content. The limited resources and skills that the average user possesses, don't allow checking whether the published information is correct and appropriate, unless there is additional editor reading-through the published content before publishing. Also due to the informal nature of UCC, there can be problems related to copyright and privacy issues.

2.2 Examples of user-created content

In this section, few of the most popular existing examples of user-created content are described shortly. Most of these examples are user communities, which are closely related to sharing UCC, such as photos, music, video or text. The tools for creating content in those communities are represented, and the motivations for creating content for those environments are analyzed.

2.2.1 Content sharing in social networking applications

Social networking applications (SNAs) are online communities that allow individuals to meet and interact by using the provided tools to establish and maintain connections with the others. These applications can be oriented towards work-related contexts (e.g. LinkedIn.com), dating (e.g. Match-doctor.com) or simply connecting people with similar interests (e.g. MySpace.com).

Although origins of the computer-based communities date back to the early days of computer networks, it is during last few years that online social network applications such as MySpace and Facebook have received mass

adoption of the public, also leading to commercial interest [33].

Social networking applications are distinguished from the first wave virtual communities in that they are often used to maintain and expand pre-existing social ties, thus extending the interaction of people from their offline communities [26].

Each user is usually presented by a profile that represents their online public persona and also often shows their connections to other profiles, with the intention of connecting new people [1]. The profiles can also contain descriptive data, photographs and other media. Profiles are used in communicating with other users, and expressing the identity of one self [12].

User-created content may be used in profiles to represent one self, or the whole community can be built around sharing content within a members with similar interests. Some social networking applications are closely linked with sharing user-created content of common interest, for example MySpace for sharing music, Flickr for sharing photos, YouTube for sharing videos (media sharing SNAs are presented more detailed in section 2.2.4).

There are both functional and social reasons to use social networking applications. Some people use SNAs for their functional needs (such as archiving or organizing), but most often they are a new way to extend our social world, allowing to extend the range of people to meet. These new applications have implications for how people connect to each other and with themselves[10]. Social networking applications share many things in common with blogs (see section 2.2.2), but they are more closely related to pure socializing, where as blogs are more concentrated on the content itself.

MySpace

Currently the most popular example of social networking applications is News Corporation owned MySpace with its over 100 million registered accounts [2] and it being the most visited website in the US topping even Google and Yahoo [76].

MySpace is successfully combining features from previous social networking applications [11]. The community is based on profiles that are connected to other users in the system. It offers the basic features to add content to profiles – where users can post blogs, photos, music and videos. MySpace also offers internal e-mail system and search engine [103].

By offering rich possibilities to include media elements in the user profile, MySpace has become a new means for independent musicians and filmmakers to gain new audience. MySpace has even created its own celebrities, who have attracted thousands of friends, thus leading to coverage in other media [103].

For many teens and adults alike, MySpace has become a part of their everyday social life; they are there because their friends are there and it's a way to hang out with them. Most time is spent modifying one's own profile by uploading media elements and editing textual content, surfing through friends' profiles and sending messages to them. Checking received messages and comments is what draws people back to MySpace every day. [11]

MySpace, like many other social networking communities, is planning to extend their service to mobile phones [60].

2.2.2 Weblogs

Weblogs (a.k.a. blogs) are frequently modified websites, allowing easy addition and updating of content. The blog entries are primarily textual and pictorial material, organized in reverse chronological order [80]. Blogging is one of the new forms of online communication and user generated content, that has gained a widespread popularity [38]. According to Perseus Development Corporation estimates, over 31 million weblogs were created in 2005 [80].

Weblogs allow easier, more flexible and interactive publishing than any previous publication format, still allowing gaining vast audience, which Herring et. al believe is the main reason behind their success [37]. Also blogging in the recent noteworthy events in the world has attracted the attention of the mainstream media, further contributing to the popularization of blogging [38]. Blogs are often considered to be a source of public opinion. Some blogs have even been considered as alternative news sources, as we have seen during the U.S. invasion of Iraq or during the tsunami period in Asia [36].

Most blogs utilize special blogging software, allowing rapid adding and updating of the content in the web page. Blog authors don't have to have technical knowledge to create a webpage since it is taken care by the blogging software, further supporting the mass adoption of blogs[38]. By allowing notifications of updated content through RSS feeds, blogs can also bridge the gap between static web pages and private and asynchronous communication.

Blogging software also allows the readers to post comments to each blog post, enabling the socializing between readers and writers [36]. Moreover, the hybrid format is well suited to express any communicative need of the author, resulting in wide range of blog genres. The following main genres of weblogs were identified by Herring et. al. [36] and Scheidt [80]:

- Filters: A filter weblog has content that is mainly external, in the form

of links to other websites or quotations by other writers.

- Personal journals: Personal journals have diary-like content such as personal thoughts and feelings. This is the most popular blog genre according to Herring et. al. [36].
- Knowledge-logs: Knowledge-logs are work related or aim to share knowledge in a specific topic.
- Multimedia blogs: The purpose of multimedia blogs is to share content created by their author. Currently people are sharing photos in photo-blogs, videos in videoblogs and audio either in music blogs or private radio shows in podcasting format (allowing them to be listened in mp3 players).
- Mixed purpose blogs: Some blogs are combining two or more genres.
- Other: There exists a small variety of blogs not fitting in the previous categories.

The characteristics of blog authors do not seem to differ significantly from the demographics of other Internet users [36] and just like many forms of user-created content, weblogs are currently mainly adopted by adolescents and young adults. According to Perseus Development Corporation study, over 92 % of blogs are created by authors under 30 years of age [80]. According to Pew Internet study, 19% of American online teens or approximately four million have created a blog and eight million are reading blogs [56]. Blogging was noted to be roughly twice as popular amongs teens than adults [56].

Blogging is characterized as socially interactive and community-like since bloggers are linking to one another and commenting each other's blogs[38]. Thus blogs are interactive, interlinked, but at the same time they can be prominent venues of individualistic and intimate forms of self-expression in textual and multimedia fashion [36]. Blogs as a form offer nothing fundamentally new, but due to their intertwined and social networked nature, they occupy a new position in the internet genre ecology [36].

Wang, Deng et al. studied the motivations behind diary-type blogging in Taiwan, and their three key findings were that [100]:

- People blog to reflect their personality and to express themselves.
- Blogs are used as event gatherers, where people collect a record of important things happening in their life

- People extend their social life by blogging. This happens by either keeping touch with real-life friends through blogging or by getting to know new people through blogging.

In addition to the previous list, Nardi, Schiana et al. found the following reasons to blog [67]:

- Blogs are used to update others on activities and whereabouts (e.g. travelblogs)
- People aim to influence others by expressing opinions in blogs
- People seek feedback and other people's opinion
- Some people are organizing their thoughts by writing
- People can release emotional tension, and deal with their feelings by writing

2.2.3 Wikipedia

One of the best examples of the power of collaborative communities is Wikipedia, which is an open-content encyclopedia created by a community of voluntary users. It is based on top of wiki technology, which allows easy editing and linking to other articles. English Wikipedia currently contains over 1,3 million articles and the Wikipedia also exists in many other languages [40].

Wikipedia has unexpectedly proved to be a high-quality and reliable source of information, even though anyone can freely edit any content. It is now even being used as a source of information in the mainstream media [40]. Unfortunately, the recent vandalism and other misuse in Wikipedia has forced to tighten the previously open-door, anyone-can-edit policy [32]. Wikipedia has also been criticized for not being reliable enough to be used as a reference [40].

Bryant, Forte et al. are distinguishing two groups of content creators in Wikipedia. The novices are the largest group, usually using Wikipedia as encyclopedia and correcting errors found. The experts on the other hand are more concerned for the overall quality of the Wikipedia and aim to make it better by growing its user community and improving the site. [14]

Many contributors see their work as contributing to a greater good by offering knowledge to others [14, 40]. These very noble selfless motivations driving

this kind of user-created content are quite rare, though similar motives are found for example on open-source software development projects [86]. The community appeal, collaboration [40] and the sense of efficacy and ownership are also considered to be the driving forces to commit content to Wikipedia [14].

2.2.4 Photo & video sharing

Photo-sharing sites and applications allow the user to upload photos to a server, where they can be shared publicly or to a limited amount of viewers. Some services allow more advanced functions such as annotating photos, sorting them into sets [64], privacy control and discussing the pictures [43]. Creating easily viewable narrative units is not currently supported by any of the popular applications [64].

Currently the most popular photo-sharing services are [41, 74]:

- Flickr (<http://www.flickr.com>)
- Photobucket.com (<http://www.photobucket.com>)
- Webshots community (<http://www.webshots.com>)
- ImageShack (<http://imageshack.us>)
- Yahoo! Photos (<http://photos.yahoo.com/>)

The level of community features is highly varied in these services; some are purely image hosting services and some are lively communities based around photography. However, most image hosting sites get most of their traffic through online communities and social networking applications such as MySpace. The growth of hosting sites goes hand in hand with the growth of user-created content and social networking sites. [74]

One good example of photo-sharing communities is Flickr, which currently contains over 300 million shared photos[28]. It's based on the concept of users uploading pictures and tagging them with loose metadata. Flickr is a self-organizing community, having no formal structure to the community, instead the users can define their own structure [101]. Flickr has also published its API to allow 3rd party developers to enhance and extend their service.

According to Morgan and Lilia, users primarily take photos and organize them for themselves in archiving purposes. They also claim that while the

social benefits are apparent, sharing photos using these sites is simply a replacement for sharing photos through e-mail. People also encourage their friends to use these services to be able to better keep track on the UCC they are creating. [64]

Motives for photo-sharing are analyzed in section 3.4.

Video sharing

One of the more recent forms of media-sharing is the sharing of videos. The videos shared online range from personal video diaries to ripped TV material. The most popular video-sharing site at the moment, YouTube, has over 100 million video views and over 65 000 video-uploads per day [23]. Some personal videos have attracted millions of viewers [85], making video-sharing sites an attractive entry point e.g. for starting film-directors and comedians.

Some of the most popular video-sharing services are [84]:

- YouTube (<http://www.youtube.com/>)
- MySpace Videos (<http://vids.myspace.com>)
- Yahoo! Video (<http://video.yahoo.com/>)
- MSN Video (<http://video.msn.com/>)
- Google Video (<http://video.google.com/>)

Many media-sharing sites are facing problems with users distributing copyrighted or otherwise unacceptable content. Therefore for example YouTube has developed technology which allows them to spot copyrighted material, allowing the sharing of ad revenue with the copyright owner [23].

2.2.5 Hobby art communities

The Internet is full of different kinds of hobby art communities, each usually concentrating on exhibiting one art form such as photography or digital art, but few general art communities have also emerged. The art in these communities is exhibited on a web page using popular media formats such as images, videos, text or animation.

One of the most popular general art communities is deviantART, with its 2 million users and over 25 million art submissions [24]. DeviantART provides the artists a relatively uncontrolled community where they can exhibit, sell

their art, discuss and get feedback for their work. Exhibited works include photography, digital art, traditional art, literature and application skins [24]. The artistic quality can vary from simple fan art to professional level original art.

The motivation for using these communities is an opportunity for artists to share their work, expand their fan base, get critical feedback and support from other similar artists and it's a chance to make money by selling art prints [62].

Notable for hobby art communities is that most members of the community are hobbyists creating content, where as in other UCC communities only small minority of users is creating most of the content.

2.2.6 User-created content in games

User-created content related to games can be seen for example in the forms of game mods and extensions, game narratives and other fan products [93]. Numerous game producers offer tools for creating content, which can be bundled with the game, parts of source code can be opened to public and modding competitions are organized officially [53]. Some game worlds are even mostly built by the users(e.g. Second Life [82]). UCC is especially vital for multiplayer game environments, where some players act as playmakers, providing resources for gameplay for others [78].

Motivations for UCC in games have been identified to attachment to community, increasing personal reputation amongst other gamers, the ability to enhance gaming environment and pure socializing aspects [78]. UCC in games is often a collaborative activity where people organize into groups where they share their expertise and skills. The groups can create an identity and a website for their activity, which can work as their publicity and distribution channel as well as a knowledge pool and a place for discussion [93].

2.3 Demographics of UCC users

The act of producing online content is no longer a privilege of the few. However, there are currently very few studies about the demographics of the content creators. According to a Pew study[55], 44% of American adult Internet users have published personally created content on the Internet.

Table 2.2: Unique visitors in top U.S. social networking sites in May 2006 [17].

Site	Million of visitors in May-06
MySpace.com	51,441
Classmates.com Sites	14,792
Facebook.com	14,069
YouTube.com	12,669
MSN Spaces	9,566
Xanga.com	7,146
Flickr.com	5,163
Yahoo! 360°	4,936
LiveJournal.com	3,904
MyYearBook.com	3,048
TOTAL VISITS	172,120

As it can be seen from table 2.2, the most popular UCC and social networking sites have succeeded in getting the attention of the masses, many increasing their popularity exponentially [19]. According to some sources (such as [99]), the MySpace user community was even the most visited Internet site in July 2006, topping for example Google, Yahoo and MSN.

The UCC site visitors seem to be very engaged in their action: they are visiting UCC sites more frequently than non-UCC sites (4.2 vs. 3.5 average usage days per month), using sites for longer periods of time (79.9 vs 33.2 average minutes per visitor) and viewing more pages (217 vs. 52 average pages per visitor). [19]

Especially the young population has quickly adopted the new hobby of content creation. According to a Pew study about teen content creators and consumers, 57% of American teens of ages 12-17, who have online access, also have created content for the internet. This amounts 12 million youth. In their study, they were asking whether teens have done one of the following activities: create a weblog or webpage; share original content such as photos, stories or video; or remix content found elsewhere into a new creation. The Pew study found very little demographic variation between content creators and other online teens. [56]

Recent studies have shown that there exists a significant age difference in between the users of different UCC sites (see table 2.3). Teens have been the early adopters in many UCC sites but they are quickly changing their favourite sites. As UCC has become mainstream activity, the age profile

Table 2.3: Age profile of the most popular U.S. UCC sites in August 2006.
Percent Composition of Total Unique Visitors. [18]

	Total UCC	MySpace.com	Facebook.com	Friendster.com
Total visitors(millions)	173,407	55,778	14,782	1,043
persons: 12-17	9,6 %	11,9 %	14,0 %	10,6 %
persons: 18-24	11,3 %	18,1 %	34,0 %	15,6 %
persons: 25-34	14,5 %	16,7 %	8,6 %	28,2 %
persons: 35-54	38,5 %	40,6 %	33,5 %	34,5 %
persons: 55+	18,0 %	11,0 %	7,6 %	8,1 %

is changing towards older age groups in many UCC sites. For example the popularity of MySpace has dramatically dropped among teenagers, while its popularity has increased among people between the ages of 35-54. [18]

Chapter 3

User-created content in mobile multimedia

In this chapter, user-created content in mobile environment is analyzed. First, the technology platform of mobile phones is introduced and various existing forms of mobile multimedia are represented. After that, different possibilities to share mobile-created content are explored and the motivations for user-created content are analyzed. Mobile photography and photo-sharing examples are studied more closely as they directly relate to the Comeks-concept.

Finally, some design guidelines for creating mobile content-creation tools are given. Different user groups of content creators are studied, and few instructions in designing functionality and usability of content creation tools are given. Also the technical platform of mobile phones is studied in respect of implementing mobile software: What restrictions and constraints are there, and how can they be taken into account in the application's design and implementation?

3.1 Mobile platform is well suited for UCC

The popularity of mobile phones has increased rapidly over the last decade and they have quickly become an essential part of our everyday life. Today's mobile phones have evolved from the mere voice-only communication device into a portable multimedia computer. Newest mobile phones have a rich set of capabilities which enable creation, presenting and exchanging multimedia content. These capabilities include color displays, built-in cameras, audio

players and high speed data connections. Through these technologies it becomes possible to download, view and even produce content on the mobile handset.

Mobile phones, as a platform for content creation tool, have many value-adding features. First of all mobile phones are private and personal devices, which are usually always with us, so they are very ubiquitous and convenient to use. By using a mobile device, the user has the possibility to produce the content wherever the user is and when ever the user wants.

Text input is slow with mobile keyboard, and the clumsy navigation key cannot compete with computer mouse as a pointer device. But current mobile phones have one new and very interesting interaction mechanism, since an increasing number of mobile phones are equipped with integrated digital cameras, some able to take high quality pictures.

Mobile photographing allows the easy creation of unique content with high expressive value. Digital and film cameras are generally used to capture images in special excursion and events. In contrast, cameraphones are always present, and the ubiquity of cameraphones facilitates the capture of more unexpected moments of everyday life. This supports different kinds of practical and functional tasks supporting social, personal and functional needs of the user.[51]

Modern mobile phones also have a rich set of technologies for creating network connections, such as GPRS, Bluetooth and WLAN. With these fast network connections it is possible to download and share content straight from the phone. According to the industry, the use of mobile multimedia will also be one of the main things in driving the adoption of faster mobile networks [51].

The software platforms of mobile phones have finally evolved to acceptable level and most of the phone's resources (e.g. display, camera and filesystem) can be accessed through a standardized API, from which J2ME, Symbian and BREW are the most common.

It is estimated that mobile phones with multimedia capabilities will be one of the most common devices to consume multimedia content [44]. Also according to Nokia Asia Pacific Multimedia Experiences director Jawahar Kanjilal, it is expected that a major share of the content for mobile phones will be created by the users of mobile phones [96]. So clearly, at least according to the industry, there exists a need for mobile content creation tools.

3.2 Current state of mobile multimedia

So far only few industries have successfully taken advantage of mobile multimedia technology. For example, the downloading of wallpapers for phones has become a popular form for teenagers to personalize the phone [51]. The academics have wondered the reasons for the low popularity of introduced mobile multimedia services. Kindberg et al. state that people like the idea of sending multimedia messages, but they find a number of obstacles to use the service [47]. It could be also that the critical mass isn't there yet to enable the new genre of picture messaging. In the study, people noted the lack of enough people to send images being a significant barrier [47].

The currently most popular forms of mobile multimedia are [51]:

- MMS messaging: creating and sharing photographs combined with text or audio
- Creating mobile photographs or video, usually shared face-to-face [47]
- Moblogs: mobile messages shared in the web
- Accessing professionally edited content, such as television or movies

Possibilities in creating more advanced content on the handset are still quite rare. The available content editing tools are often cumbersome to use and there is very few tools to choose from. Very few mobile applications are using the full scale of mobile phone's media capabilities. Most currently available applications have simply made it possible to use traditional mediums in the mobile environment, making it possible to view, create, organize and share for example photographs or video. Only few applications support the creation and sharing of narrative stories, combining different mediums [64, p.69].

Some current forms of mobile user-created content have been born in the space between Internet and mobile phones, often offering possibilities to upload content to a network server (e.g. moblogging). These forms of mobile multimedia are still quite rare even in Asian countries where the mobile multimedia culture is most advanced [51]. More refined forms of multimedia such as mobile TV and mobile movies are waiting for faster and cheaper networks and better handsets in order to get mass adoption.

According to Jacucci et al. mobile multimedia will become popular in the long run, since it is easily used for various purposes. They claim that as long as a new technology supports interaction and doing things together, people

will find ways to use it in socializing and entertaining each other. They also instruct that successful forms of mobile multimedia should support mundane communication, have easy user interface, allow responding smoothly and support playful expression in addition to rational uses. [43]

3.3 Sharing the content

As recent popularity of sharing user-created content through e-mail and web-based photo sharing services shows, sharing is becoming essential means of archiving content and a new way to communicate and do social bonding [30].

Even though sharing is certainly not the only motivation to do user-created mobile content, it is still a very important one [22]. It seems that socializing with mobile phones is becoming more common all the time, even though the users have not yet completely found the proper social protocols to share mobile multimedia content in larger scale.

As seen in figure 3.1, content created with mobile phone can be shared synchronously between people co-located in time and place or separated by distance or time [29]. The simplest and the most common [47] way of sharing content with people co-located in time and place is to present the content from the device's screen to the intended audience, for example to show an image just taken. This form of sharing is very secure to the author, since there is no risk that the shared content could be misused [44].

Table 3.1: The dimensions of sharing [29]

	same time	different time
same place	CO-PRESENT SHARING: device's screen prints, slides, projector	ARCHIVING: archiving programs photo-sharing services
different place	REMOTE SHARING: instant messaging MMS	SENDING: e-mail photo-sharing services

Mobile phone is often used as a portable photo archive that is used in face-to-face interaction. The recently introduced functionalities in mobile phones have transformed their previously highly private role into more social and interactive one. Cameraphones are often shared and swapped between friends when showing pictures from the phone's screen. [81]

User-created mobile content is most commonly shared with others who were at the same event or those that "should have been there". Other common audience is distant family members and friends. Content shared with strangers happens usually through weblogs or other web-based communities. [64]

According to Teng, Wu et al., users usually want to perform simple and quick editing functions to the content before sharing it. This could include removing unrelated content or combining many media elements. They state that users prefer to edit their content directly on the mobile phone, rather than transfer the content to a personal computer for editing. This is because users wish to share their personal experiences when and where they are happening. Also many mobile users don't have the necessary computing skills to transfer the content to computer and use complicated content editing tools. [92]

3.3.1 Web-based sharing

Currently, mobile content can be shared online using mobile blogs or media-sharing services. Blogging from mobile devices, also called "moblogging" is an attempt to extend the blogging activities to mobile environment. Blogging from mobile phones is usually related to adding short textual information or photos to blogs[100].

Some currently existing web-based media-sharing services for mobile phones are:

- Kodak Mobile (<http://www.kodakmobile.com>) : storing, sharing and printing pictures
- Nokia Lifeblog (<http://www.nokia.com/lifeblog>) : moblogging, organizing and sharing pictures and videos
- ShoZu (<http://www.shozu.com>) : mobile application that allows sharing mobile media with popular desktop media-sharing services (see section 2.2.4)
- Textamerica.com (<http://www.textamerica.com>) : storing and sharing pictures, moblogging, community features

According to Koskinen, moblogging is almost completely centered around sharing personal photos rather than sharing "serious" information, even though moblogging has the ability to empower more interesting acts such as citizen journalism [51].

With the millions of cameraphones in the society, new kinds of newsworthy events can become photographed and citizens have the ability to react faster than media organizations. This was seen for example during the London terrorist acts in 2005, when mobile photos and videos ended in mainstream media. Citizen journalism is also more difficult to control and regulate by the authorities, leading to both positive and negative consequences. [51]

Currently moblogging is still a niche phenomenon [51] with the exception of some Asian countries [100]. It seems that moblogging is not adding enough value for the user to make it attractive. In Wand, Deng et. al's studies, mobile blogging seemed attractive to users at first, but they quickly stopped updating their blogs due to lack of incentives, bad image quality of mobile photos and due to operational difficulties in the mobile phone [100].

3.3.2 Multimedia messaging

Currently the most popular of sharing mobile content remotely is messaging by using the MMS service or mobile email service. In messaging, the content is sent from one phone to another, thus being the most straightforward and pretty much the only available way to share multimedia content asynchronously between mobile phones[44]. Messaging also allows the users to collaborate and communicate on the move, without the restrictions of physical spaces and allowing the users to take advantage of the richness and flexibility of the real world [30].

Messaging requires that the message sender knows the receiver beforehand and has their contact information. Also with current technologies such as MMS, content has to be sent to each receiver separately.

MMS

MMS is a store and forward messaging system for multimedia messages, having similar general design to SMS. MMS standard offers possibilities to combine photos, sound and text.

MMS was expected to be the next commercial success in mobile services, enjoying the same popularity as SMS. However it failed to meet the high expectations and recent studies have shown that in fact, the interest in MMS has reduced [73]. Scholars have found technical, economical and social reasons for the low success of multimedia messaging:

Technical issues:

- The cumbersome configuration needed in the handset [43]

- Unreliability of delivery [43], especially between carriers
- Low usability of the message creation process [73]
- Poor quality of media elements[50]

Economical issues:

- Too high price in comparison to SMS [43]

Social issues:

- Low penetration of MMS, so people don't encourage each other to send messages [73]
- Lack of attractive use cases and daily need for using it [73]
- Interpretive problems: How to answer questions introduced by the media elements of the message? [50]
- Interactional problems: How to respond to an MMS message? What is significant enough to send?[50]
- Sharing of visual content, in contrast to text messages, is considered to be more selective and intimate experience [92]

3.4 Motivations for creating mobile UCC

Over the past few years, a number of researchers have been interested in the use of personal photographs and especially on aspects of users sharing photos with each other. Most of the studies presented here are closely related to Comeks concept, by being related to photo sharing, camera phone usage and other mobile multimedia usage; however many findings can be generalized to other forms of UCC.

Van House, Davis et al. [95] studied what people did with cameraphones, when photography was a daily activity, not requiring forethought in carrying a camera. Their study showed that cameraphones encouraged frequent, spontaneous photos of everyday situations such as photos of friends, humorous sights and aesthetic sights. Several people also reported to take photos to pass spare time. Playfulness and sociality are associated with the use of cameraphones, especially by young people [81].

Kindberg et al. distinguish two dimensions in the user's motivations in sharing mobile photos: affective versus functional dimension and social versus individual dimension (see figure 3.2).

Table 3.2: The dimensions of mobile UCC motivations [47]

	Social		Individual
Affective	enrich a shared experience	communicate with absent friends or family	Personal reflection
Functional	support a mutual task	support a remote task	support a personal task

Affective dimension is meaning images that are captured for sentimental or emotional reasons, ranging from joking to showing one's affection. The functional images on the other hand, are taken to support a task. The social dimension is meaning that images were taken to be shared with other people. The individual images were taken for personal use only. In looking at social uses, Kindberg et al. also distinguish between sharing people co-present at time of the image capture versus sharing with those not present. [47]

When looking at the mobile UCC motives more closely, the following six distinguishable groups of motivations have been identified in different studies:

- Preservation of memories
- Social interaction
- Transmitting emotions and moods
- Personal storytelling
- Self-expression & self-presentation
- Functional uses

These motivation groups are analyzed in the following subsections.

3.4.1 Preservation of memories

A photo is thought of as a frozen moment in time, and so viewing a photo is a step backward in time, being a way to share experiences with others.

Photos can be used as memory banks, by documenting social relationships and changes in them; thus as a tool to order the mundane world [50].

In Van House and Davis study, construction and preservation of personal and group memory was noted to be one of the major motivations behind photography [94](also indentified by Mäkelä et al. [63] and Scifo [81]). In other words, photographs are used to interpret life to others and to oneself by documenting it [50].

Camera phones are changing our view on what is noteworthy, since they follow people everywhere and require no forethought in carrying the camera [50]. What is worth documenting is not only individual and subjective choice, but also dependent on the cultural context [39]. Many people are also using their mobile phones as easily available archive of memories [81].

3.4.2 Social interaction

Mobile phones with built-in cameras are not just devices for capturing images for personal purposes, whereas they possess a great potential in inspiring to visual communication. User-created content is not going to replace older forms of human interaction, but it is becoming a new way to communicate and to create and maintain relationships.

Motivation for taking the picture is very often related to interaction or communication. In a Radiolinja pilot, studied by Koskinen [49], it was shown that 50% of messages arose from interactional needs rather than from individual and unattached messages. In the study by Frohlich et al. [29], it was observed that people experience as much joy from the feedback and conversation around the content created as they do from sending or receiving the content itself.

In the study of the MMS use of young Milanese, Scifo learned that mobile multimedia is mainly used in small groups [81]. Her findings are supported by Kindberg et al., who also argue that people tend to capture events relevant to the small group rather than the society at large [47].

Users create ways to make existing technologies and products work in for them in social interaction. In many cases technologies that were created for business environment or otherwise "serious" communication, turn out to have great potential in the social communication. In this way technology is not used for substituting the actual with virtual space but rather the technology functions to further connect individuals in the actual physical world. In fact it should be essential in the lifecycle of the technology development, to

study innovative interactive uses and solutions that users can find for the technology .[6]

The following communicative genres of mobile UCC have been distinguished in different studies:

Maintaining and constructing relationships

In the study by Van House and Davis, it was observed that photos help to maintain social relationships and even construct them. Photographs may do this either through their content, how they are used, or in the process of photography itself [94]. The act of viewing pictures together is important in reinforcing relationships because of the shared stories and experiences[94]. Sharing photos distantly is also one way to keep up with one another's lives [95].

Performative messaging

Even though mobile phone is considered to be a personal device, the mobile content creation is often a social action. While typing an SMS is not likely to be done together, creating a multimedia message together is found to be easy and attractive. The action of multimedia message creation is more open and it allows the participation and collaboration of others [7]. The authoring of multimedia messages is considered to be a performance where people can express themselves and convey a particular message to others[81].

This kind of collaborative user experience, which is created from the seamless blend of user experience of technical products combined with social interaction related to it, is often called co-experience. [6]

Ordinary form to interact

Koskinen sees mobile photography and multimedia messaging as an ordinary form to interact on its own. Multimedia messaging is often used in ways that are different from other ways of communication. According to Koskinen, people capture and share the ordinary things, but combine those images with elements that account and explain the content into something exciting to justify the sending of the message. [51]

3.4.3 Transmitting emotions and moods

According to Scifo, mobile UCC is often used for sentimental purposes, giving other access to private places, situations and emotions[81]. For example in a EU-funded Maypole project, it was shown that mobile photos were frequently used for emotional communication, by creating multimedia messages that

involved emotional meanings for the sender or the receiver [49].

MMS allows more visual communication, thus introducing a new visual vocabulary in creating or interpreting MMS. In the study by Battarbee it was observed that the richness of the message content was increased with the inclusion of multiple medias. This was not only due to the richer description of reality it allows, but also due to possibilities it offered for interpretation. Messages with many media elements were considered to transmit mood, humor and emotion better than picture-only messages. [6] Sending messages with conversational media elements (e.g. voice and text) can be used in compensating the lack of real-time conversation [48].

Emotional communication can be seen for example in the following ways to use mobile UCC:

Enhancing a moment

One common social reason for creating mobile UCC is to enrich a mutual experience by sharing the content. This could be done at the moment of the experience by sharing content with people not co-present. Shared moment can also be enhanced later by sharing or viewing the image together with people who were present at that time.

By creating and sharing multimedia content, the sender can give the receiver access to his current situation. As seen in Scifo's studies, multimedia messages were often used as a proof and authentication of one's physical presence in certain situations and places. These messages are shared with absent members of the social group [51], often meant to entertain or tease them by saying "I'm here and you're not". [81]

Message as a gift

The intimacy of photographic process and picture exchange makes people to consider some multimedia messages as gifts[81]. To send a multimedia message can be an act of confidence and trust; just like sending a thoughtful and nicely written SMS. As with SMS messages, to receive a message usually means that the receiver is expected to return some kind of reply [54].

This kind of behavior could be compared to sending postcards when traveling. Contents of postcard have very little value, but it is the act of sending and receiving that gives us pleasure [54]. Sending messages as gifts is closely related to exchanging presence information, described in the next paragraphs.

Exchanging presence information

The purpose of sending multimedia message is not often about communicating a specific message, but rather to make an emotional connection by

expressing that the sender is thinking of the receiver[54]. Volda and Mynatt identified that multimedia messaging is regularly centered on exchanging presence information, such as mood and location. They also state that one recently adopted function of images is to provide awareness, meaning that people like to see for example what their friends or coworkers are doing at the moment (see also [63]). This kind of use for images has been made possible by computer networks and capture and playback devices becoming more common.[98]

Multimedia messages can be used as tool to make a simple connection by sharing mundane events, thus creating visual co-presence with those not present [81, 58]. The "utility" of the message is of secondary importance; instead multimedia message is considered to be just a symbol to keep the social relationship fresh [54].

3.4.4 Personal storytelling

Often mobile devices are used just to record an event in everyday life which is assembled into a story at a later stage. Mäkelä et al. [63] found that a will to create stories or art can be a driver to take pictures. Photos are often organized into a sequence, thus used in creating a narrative or story. Using images as narrative is influenced by the control of the author, as he or she can control what is included in the narrative and what is left out [98].

Some scholars, such as Burgess, claim that user based content creation is usually a form of vernacular creativity – meaning that people are using ordinary practices of creativity that are part of their everyday life. Thus, personal content creators are articulating modern consumer practices, such as television or genre codes, with older popular communicative practices, such as family photography, scrap booking and everyday chat. [15]

The skills and competencies of content creators are built up through their everyday experience in mass media consumers, and those skills are used to tell those same personal stories in digital form that used to be told using traditional practices such as photography.[15]

Burgess stresses that user-created content should not be compared or deprecated in comparison to existing pure or authentic folk cultures; instead it should be entitled as autonomous and valuable contribution to public culture. In user-created content, especially in digital storytelling, narrative accessibility, warmth and presence are prioritized over form and technological virtuosity. The style of digital stories is usually emotional and touching, thus retaining the warmth of human intimacy despite the dominance of

technology.[15]

3.4.5 Entertainment

Humor is one essential aspect in user-created content [63]. People like to create humorous content and comment others' creations in humorous ways. Also the immediacy and interaction of mobile technology turns the social activity of sharing pictures into a play-like activity, which has an entertaining value itself [79].

The playing around with mobile phones is often related to socializing, which refers to a vital social activity that is not necessarily task-related [54]. This phenomenon can be seen especially among young mobile and internet users. Messaging with friends, taking photos and other content creation and sharing tasks are done to pass time and entertain one self and others while waiting. This play-like socializing around media content happens most often with friends, relatives and acquaintances [93].

Some entertaining messaging involves both sender and recipient taking part in the creative action [6]. The sender usually includes some kind of story, joke or puzzle in the message to be sent and the receiver must interpret this and quite possibly comment the message. This kind of messages are often chain-messages, circulating in and between small groups [58].

3.4.6 Self-expression & self-presentation

According to studies mentioned before, content creation by average users is rarely about creating art, it's more a communicative and social action. Nevertheless, creativity is still one of the main drivers in creating content, but in this context it's not the domain of designers, but the creativity of ordinary people in their lives [13].

Self-presentation is about influencing others' view of one self. Usually this is done in the forms of self-portraits or creating content of one's friends and social space. Personal blogs, webpages or user profiles in social networking applications are common tools for self-presentation.[94]

Self-expression is about showing people what kind of person one is and this kind of content's primary value is aesthetic or artistic [94]. Ordinary people's self-expression through art has been devalued for hundreds of years, but it seems that modern digital content creation tools and publishing services are making average people interested in creating art again [13].

People don't necessarily create expressive content because they want it to be popular, however there seems to be a natural need to exhibit productions of creativity to other people and seek for acceptance and positive feedback. People also like to get critical feedback in order to learn and get better. Hobby art creators have nowadays large web communities (e.g. DeviantART [24]) where people publish their creations and get feedback and grading from other users (see section 2.2.5).

3.4.7 Functional uses

Some UCC can be functional, either for one self or for others. User-created content can have highly informative function when used in visual communication [81]. For example in the Van House and Davis study, some mobile photos were used when doing instructions for others, or in place of writing, copying or scanning[94]. UCC can be used as a tool for documenting work related objects: recording a situation for later reference or evidence and when visualizing specific details or personal reminders [51].

UCC can also be problem-solving; for example instrumental and pragmatic photos can be used effectively in explaining concepts or when doing instructions for others [81].

3.5 Designing content creation tools for mobile phones

This section's purpose is to give the reader few general guidelines in designing content creation tools for mobile phones. The typical user groups of mobile content creators are studied first, then some instructions in designing functionality for selected user group are given. Next, few guidelines to design usability in mobile environment are given and mobile phones' restrictions and design limits are analyzed. Finally, the most common software platforms of mobile phones are introduced.

3.5.1 Choosing target users

First thing to do after the initial concept idea is to choose the target audience for the content creation tool. It's useful to analyze the intended user group closely, and see what their needs and requirements are.

Jokela [44] and Isomursu et al. [42] distinguish different user groups of content creators by the level of their skills:

- professional content creators:
 - earn their living by creating content
 - creates content to be published in mass media
- semiprofessionals:
 - work in the field but don't earn a full living from it
 - creates content to be published in small scale (Internet, festivals, etc.)
- hobbyists:
 - creates content as an active hobby
 - motive to create content is often to support another hobby (e.g. snowboarding)
 - often co-operates with other hobbyists
 - recorded material includes hobby events and other targets of interest
 - shares material in communities
- amateurs (called ordinary users by Jokela [44]):
 - creates content for their own fun
 - more methodical and willing to try new things than casual shooters
 - records material in occasions together, travels and other good moments and mementos
 - shares content with friends and family, good works can spread around the world
- casuals:
 - creates content on impulse
 - hardly does any editing of content

- records material in family occasions, travels and other good moments and mementos
- material restricted to own and family use

Each group has different level of skills and resources for creating content. Obviously, amateur and casual users are the most prominent groups in mobile environment to create content creation tools to. Other groups have the time and knowledge to rather produce the content using more sophisticated tools [44]. However, hobbyists might be interested in using it too, if mobile platform can bring additional value in comparison to desktop tools.

According to Jokela, the amateur (and casual) users want to produce content quickly and easily, and they prefer using only the mobile phone. For them the authoring of multimedia content should be made easy as possible with mobile tools that are easy to learn and quick to use. [44]

Naturally, the target audience is usually a subgroup of the groups presented above, and it is dependent of the content creation tool's concept and usage possibilities.

3.5.2 Designing functionality

Prior to designing a mobile application, developer must consider whether it even makes sense to create the application in mobile environment [102]. Since desktop applications transform poorly to mobile screens and user interaction methods, the product concept should be analyzed in relation to mobile use and whether there exists a need for the application in the target group. If the application concept proves to be attractive, next thing to do is refine the concept, and choose feature set that appeals to the target group.

By analyzing their field studies, Mäkelä et al. listed few general requirements for mobile content creation tools [63]:

- Images are not enough for functional communication, thus there should be a possibility to annotation with audio or text
- Some users want to create longer stories, e.g. by creating a series of images
- Users want to have large set of editing possibilities
- Storing and easy sharing in various ways (wireless, direct from screen, etc.) should be supported, web based sharing was preferred at time of their field studies

3.5.3 Usability considerations

In the case of user-created content, the technology and the user interface should be designed so that it invites to exploration and supports the playfulness of narrative creation [64]. Creating multimedia content should be entertaining in itself [44]. Also, instead of focusing only in the individualistically oriented approach of experience design, the collective creativity should be studied and understood [6]. Consequently, in addition to user interface design, it's equally important to design how the designed technology can be used in interaction and communication.

User Interface design

Usability is often defined as a quality of a system in accomplishing the user's goals, with respect to ease of use and learning, and the satisfaction of the use [91].

Usability should have top priority in the design cycle of any mobile application, since the user interface is one of the key ingredients in facilitating a pleasant and rich mobile user experience [87]. While a good desktop interface cannot easily be transformed to mobile environment, the basic principles of interface design also apply there. User interface's consistency, use of feedback, shortcuts, error prevention and easy undo function are principles that should be used when designing a mobile user interface [91].

When designing a user interface for mobile application, the developer must consider the constraints of mobile phones introduced in section 3.5.4. A good mobile user interface is usually a tradeoff between simplicity and rich feature set [92]. In the case of content production tools, the simplicity brings the needed ease-of-use and short learning curve, but if the usage is restricted too much, the exploration of variations becomes more inconvenient for more advanced users.

3.5.4 Restrictions of mobile phones

Mobile phones are currently quite demanding platform for creating content production tools. While they have become quite powerful computing platforms, they still set many restrictions to the application [44]. These technological and user-related constraints of mobile phones must be taken into account during designing and developing the software.

The device related limitations include limited processing power and storage capacity, small display size, inconvenient user-interaction mechanisms

and limited battery power [92]. In comparison to desktop computers, the communication technology of mobile phones has higher error rates, more disconnections and lower bandwidth [87].

User-related constraints are related to the way mobile phones are used: limited user attention, changing locations [87] and most user's have low level of computing experience and low tolerance for learning something new [92].

Despite the fast technological advancement, most of these constraints are likely to persist in the near future, since these relate to the core product concept [44], mobile phones need to be small, light and cheap [87]. Due to technical limitations, the amount of information fitting on the screen is limited and interaction is more difficult. Thus, the feature set and complexity of the application must be smaller than in the desktop environment [44].

Also the user-related constraints require interfaces that are more simple and easier to use and learn [92]. This requires careful planning in the application design phase and desktop applications cannot be simply transformed to mobile devices. The essential feature set must be identified and a suitable user interface must be designed carefully, keeping in mind the context of use [30]. Also the application's software implementation must take into account the hardware constraints, such as low memory capacity [44].

One major issue in designing software for mobile phones is the device fragmentation. There are hundreds of different phone models from several manufacturers, each having their own set of capabilities and varying UI conventions [102]. This creates a challenge for the developer, since the application is usually ported to run on maximum amount of handsets.

3.5.5 Software platforms

The first generation of mobile phones had fixed set of functions and applications, however the functionality of current generation's phones can be extended with new applications [44]. Applications can be either native applications, which are communicating directly with the phone's operating system (OS), or they can use phone's functionality through additional software layer which is built on top of the OS. Most common examples of the latter are J2ME-, Flash Lite- and web-browser-based applications. They have more limited access to phone's resources but they are easier and faster to develop [44].

Native applications

Standard operating systems have recently become more common in the higher-

end mobile phones, allowing third party developers to create native applications. Currently, the most common operating systems is Symbian used mainly in Nokia S60 phones [59]. Also Binary Runtime Environment of Wireless (BREW), popular in Northern America, allows the creation of native applications through application development platform which sits directly on top of the hardware layer of the device [75].

Applications created for Symbian and BREW can access most of the capabilities of the phone and since the code is compiled to machine language, they are faster in comparison to non-native applications [21]. The API implementations are also more consistent than J2ME APIs across the supported devices. The disadvantage in creating native applications is the smaller amount of available handsets and longer development times due to complexity of the provided APIs, required low level coding and poor documentation.

Non-native applications

J2ME is a collection of application program interfaces (APIs) relevant to mobile devices, using Sun Microsystems Java-technology. J2ME APIs are used to communicate to Java's connected limited device configuration (CLDC), which serves as an interface between the application and the phone's operating system. [88]

J2ME offers good market penetration, faster development times, good documentation and large developer community [21]. In the down side, J2ME applications are slower, can access only a limited amount of phone's features and even though J2ME code is portable to different platforms, the code usually needs adjustments in coping with different screen sizes [21] and different set of capabilities.

Sun hasn't provided binary implementations of the runtime environments for mobile devices, so phone manufacturers have needed to create their own implementations. The standardization of new APIs hasn't always kept up with the fast pace of technology development causing the manufacturers to create their proprietary extensions to standard APIs. Also, some of the manufacturer's Java implementations are poorly implemented and buggy, causing difficulties in porting the application to different phones.

Other non-native software platforms such as Adobe's Flash Lite [3], are still quite rare and only few phones have runtime environments for them, they also have even more limited access to phone's resources than J2ME. Using browser-based applications (such as WAP) it's currently only possible to access very few phone's capabilities, thus they are only suitable for very limited uses.

Chapter 4

Comics & Technology

In order to get better understanding about the medium of comics, comic literature was studied and the summary of main findings are presented here. This chapter's purpose is also to give the reader necessary information to better understand the comic format. Also examples of the use of comics with new technological platforms is presented.

4.1 Basics of comic theory

There is a preconception surrounding comics, that comics are childish and simple funny stories for the masses, and therefore, have no artistic or literary value. Many artists and scholars have proven that such thought is far from the truth (such as McCloud [61] and Sabin [77]).

This section's aim is to show that comics can be one of the most potent and expressive mediums available. Comics are a very good appliance in human to human communication and the use of comic style storytelling is well suited for the mobile environment.

4.1.1 Definition of comics

Comics seem to be difficult to define, since there are so many different forms, genres and styles. Most scholars agree that comics consist of sequential images and most often there is interdependence of static image and text. Image and text are typically used in tight interdependence, complementing each other, but either element can also be dominating the expression [35, p.

26, 41, 59]. In terms of content, most comic strips aim to tell a story, hence making a difference between caricatures [35, p. 22].

McCloud defines in his book, which is widely considered one of the most definitive texts on the theory of comics, that comics are

"Juxtaposed pictorial and other images in deliberate sequence, intended to convey information and/or to produce an aesthetic response in the viewer." [61, p. 9]

4.1.2 Basic elements of comics

Comics are a special form of presenting information, having common conventions that form the visual vocabulary of comics [35, p. 21]. All the information coded in comics using these conventions must be able to interpret in order to fully understand the comic. Interpreting modern comics requires skills which can be only conceived by reading comics. In comics, every aspect of the comic vocabulary used, affects on other elements in the comic [57]. For example the shape of a frame affects on how the content of the frame is interpreted but also the contents of the story affect on the interpreted meaning of each symbol within a frame.

Bordered frames

Bordered frames are one basic visual convention found in almost every comic strip. These bordered panels break down the action into frames that show fractions of time and space in the story. Borders are also used to crop the image, thus choosing what is left outside the picture to be completed by the reader's imagination [35, p. 27].

A sequence of comic frames causes a reader to link the information showed in each frame, thus the reader mentally constructs a continuous, unified reality [61, p. 67]. This effect is called "closure" and it is one the key elements in the language of comics. The same effect can be seen in films as well, but successful reading of comics often requires more imagination to fill the gaps between frames [61, p. 69].

One frame can be used to represent one place but the duration of time it represents can vary from a single moment to longer period of time. Usually the size of the frame is related with the duration of action it represents [57]. Often the larger the frame size is, the longer period of time it represents. But the size of the frame can also depict the mood of the story. Within one frame, strips often make use of cinema-like compositions such as close-ups

and panoramas [77, p. 6].

Also the arrangement of panels can be used as a means of story telling or just as an effect. Normally frames are arranged as lines of constant height frames, each containing three or four frames [57]. But the frames can be arranged in many other ways, partly overlapping or completely in free order.

Icons

Other example of comic conventions are the various icons which are usually simplified images that can be used to represent a person, place, thing or idea [61, p. 27]. These icons are used to represent the non-verbal and invisible things, such as senses and moods. Simple lines can symbolize for example smell, pain or character's feelings. Motion lines are commonly used to create an illusion of movement.

These icons are utilizing the traditions of pictorial and textual expression in a metaphorical way [35, p. 46]. They have evolved throughout the history of comics and some have become a part of the common vocabulary in comics. Some symbols have defined meanings, such as heart as a symbol of love or stars as a symbol of pain. On the other hand the meaning of some symbols can only be understood in context of the comic frame [57].

Representing speech & sounds

Dialogue is typically presented in speech bubbles. The shape of the bubble and the font used can be used to represent many qualities related to speaker's voice [35, p. 42]. Usually there is a tail attached to the speech bubble which indicates source of sound.

Sound effects and other sounds are often expressed as stylized onomatopoeic words such as "Bang!" or "Splat!". In the case of sound effects the stylization of the onomatopoeic word is very important in conceiving the sound. The presentation of the sound effects is often more close to a picture shape than a written word [57], blurring the line between pictures and words.

4.1.3 A short history of comics

The history of comics is largely dependent of the definition. The invention of comics can either be seen in the mid 1800's when the newspapers started to print first comic strips or as according to McCloud, precedents of the comic art format can be seen as far as in the hieroglyphs of Egypt and in the pre-Columbian picture manuscripts in Mayan temples [61, p. 10-15].

But it was not until 19th century, when Rodolphe Töpffer created a new

pictorial language in his picture stories. He used comic-like vocabulary such as cartooning of images, panel borders and the combination of words and pictures. [61, p. 17]

It is common to associate the first comic book to Richard Fenton Outcalt's creation, *The Yellow Kid*, in 1896. Outcalt essentially synthesized what had been made before him and introduced a new element: the speech bubble, a space where he wrote what the characters said, and that pointed to their mouth with a tail. In the first decades of its life, comic books were essentially humoristic or satirical, and this is the explanation for the name they carry to date in English language.[77, p. 13]

The Comics and the comic industry evolved, and spread its arms, becoming part of mass culture. The 1950's staged the greatest witch-hunt of comics ever, and a lot of prejudice from those days still remains. Psychiatrist Frederic Wertham wrote a book, *The Seduction of the Innocent*, where he accused comic books of causing youth corruption and juvenile delinquency. A censorship agreement, called Comics Code was then created which destined to limit and rule on what could appear (and what could not) in the pages of comic books. [46, p. 11]

Ironically as counter reaction to Comic Code [35, p. 28], the adult comics started to evolve and get respect as an art form. Comics with more artistic value started appear and genres such as underground comics, art comics and graphic novels were born [35, p. 11]. Nowadays comics have hundreds of different styles and subgenres. The art form of comics is still enjoying wide popularity even though it has gotten competition from other forms of popular culture. In 2005 just the comic book sales were worth over 500 million US dollars [34].

4.1.4 The value of comics in communication

Comics, of course, are just one form of self-expression and communication mediums available. However, they have many advantages which make them suitable to express a large variety of styles and genres, while being easy to produce and read.

The comics are seemingly universal in their simplicity and accessibility as a medium, whilst they can be fiercely local in their content and appeal. One of the advantages of the pictorial storytelling is that it can appeal to any audience regardless of the language or location.

A comic gag or a story rarely needs an introduction since the reader is im-

mediately guided to the scene, thus instantaneously understanding what the context of the story is. Comic techniques can be used to make hardly explained story shorter and more compact [52]. It's proven that most people can understand the point of a comic story, even though they wouldn't understand the written language. Even the US Army has used comic books in spreading the propaganda in the Middle East [70].

Even though the art form of comics is centuries old, it still suffers from the curse of all new media; that is being judged by the standards of the old media [61, p. 151]. Comics are often compared to film, prose and animation. As literature, comic books are read and stories are told also by words. However, comics are most distinguished from books by the pictorial expression of comics. Comic's pictorial language also shares many narrational elements with film, such as telling stories with series of pictures, cropping, and use of angles of view. But the viewing experience is completely different, since comics are read frame by frame, since they are consisting of static images and text in sequence. Therefore comics should be regarded as independent form of expression. [35, p. 94]

One advantage of comics is that they are quite easy and cheap to create and publish, and there is no need for big production team and large investments [35, p. 12]. However, comic strips can express information in clear and easily understandable manner. Because of this very fact, comics are incredibly useful in teaching new concepts to people [57]. Many technical manuals recognize that illustrations combined with text are the most effective way to explain complicated things. Text is often easier to decipher when there is a context provided by the illustrative sequence.

The style of comic and the usage of comic vocabulary are up to the comic creator and their possibilities in telling the same story using comic-style storytelling are varied. The same story can be expressed realistically or caricatured, using many frames or just one frame, with pictures or text or with combination of both. This has enabled the comics to expand into wide variety of different genres and styles. Also many subcultures (e.g. horror and sci-fi) have seen the possibilities of comics in representing, sharing and spreading the values of the subculture [35, p. 13].

4.2 Examples of comics and technology

Comeks is by no means the first application to enable comic creation. However, comic form is utilized in surprisingly few cases and there is still lot of

potential to explore new ways to use comic and technology together. In this section, few of the existing forms of comics combined with technology are presented.

4.2.1 Desktop based comic creators

Comic Life

Comic Life, a winner of Apple Design Awards, is a comic creation software for Mac OS 10.3 and newer. It's based on the idea of combining digital images with comic elements, offering large variety of editing possibilities with relatively attractive and well designed user interface. However, due to wide variety of editing possibilities, its usage is quite complicated and comparable to using normal image editors. But with a little practicing it is possible to create professional looking comics with it. [72]

Comic Book Creator

Comic Book Creator, sold with different brands (e.g. Marvel, Nacho Libre) is a Windows based drag-and-drop comic creator. It's designed to be used with branded ready-made content, allowing the user to create stories by combining clipart and background images (though adding own artwork is also supported). It offers less creative freedom than Comic Life and has clumsier user interface, but otherwise programs are quite similar. [71]

4.2.2 Online comic creators

All the comic creation tools currently found online are quite limited for general and serious use, offering very limited editing possibilities. Most are offering just customized speech bubbles, and choosing predefined elements from provided artwork.

Some examples of online comic creators are:

- Stripcreator.com (<http://www.stripcreator.com/make.php>): only predefined art available, restricted to three frames
- ReadWriteThink: Student Materials: Comic Creator (<http://www.readwritethink.org/materials/comic/>): comic creator for child students, only predefined art available, restricted to 1-6 frames
- Garfield's Comic Creator (<http://www.nhlbi.nih.gov/health/public/sleep/starslp/missionz/comic.htm>):

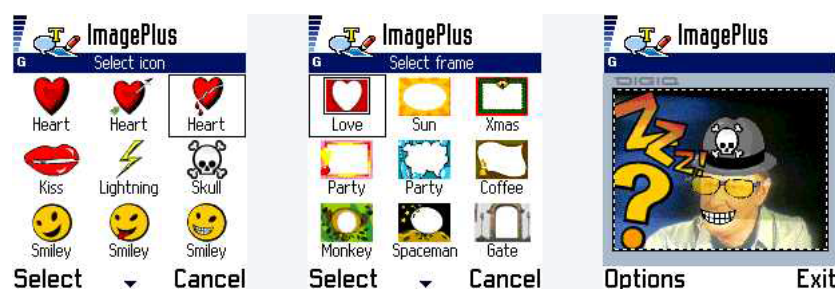


Figure 4.1: Screen captures of Digia ImagePlus [66]

only predefined art available, sharing only by printing, otherwise quite advanced

4.2.3 Mobile comic creators

The only full-blown mobile comic creator currently available is Comeks. However there are many mobile tools which have taken elements from the comic world. For example MMS editors in some phone models allow the addition of speech bubbles to cameraphone images.

Digia ImagePlus

Digia ImagePlus, also a Symbian application, is the closest contender to Comeks. It also offers the possibility to take images with mobile phone's camera, apply filters, and add few icons and non-comic related frames, which are used as templates (see figure 4.1).

However, ImagePlus is only concentrated on editing a single image and it doesn't support multiframe storytelling. It's more designed to make a single image funny looking than to support comic-like story telling. Its user interface is also menu based, which makes it slow to use in the long run.

4.2.4 Webcomics

Webcomics or online comics are comic strips published online. Some are exclusive online published but many have also printed versions. Currently there are over 7700 webcomics published online. [27]

Many webcomics are digitally produced, using digital illustration programs. Some comic creators are using copy-pasted characters from games, digital photographs (see figure 4.2 for example made with of Lego characters) or

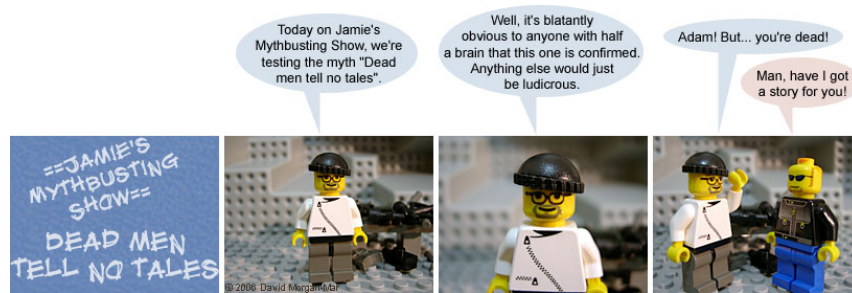


Figure 4.2: Example of webcomic strip [65]

clipart. Traditional hand drawn comics are also available. [105]

Even though the traditional comic strip format is still the most popular format in the web, the publishing form has also brought new experiments to the comic expression. McCloud, one of the first advocates of webcomics, introduced the idea of infinite canvas where story can spread in any direction. Also usages of animation, interactive comics and hyperlinks have been experimented. [105]

Readers and creators of webcomics have quite active online community. Many artists have managed to create a fan base through the use of blogs and discussion forums and there are also emerging general webcomic communities (e.g. buzzComix!, <http://www.buzzcomix.net/>). Currently, webcomic publishers are making money by advertisement, donations, subscription services and merchandise selling. [105]

4.2.5 Mobile comics

Mobile comics are similar to webcomics, but they are viewed from the mobile phone's screen. There are several services offering comic strips in MMS or other multimedia formats. Most available mobile comics are mobile adapted versions of many popular printed comics. They can be simply digitized images in MMS format, or animated slideshows which require a dedicated viewer to be installed in the phone. Due to limited screen sizes, comics are read panel by panel.

Mobile comics have achieved mass adoption in Japan, where mobile comic sales were worth 19.6 US dollars, which is twice as much as comic sales on PC. According to recent studies and to publishers' surprise, Japanese people are using mobile phones to read comics at home. Other surprise is that 60 percent of the readers are women. [45]

Chapter 5

Implementation of Comeks

In this chapter, the design and implementation of Comeks application is studied in detail. First the selection of application's target users and its different user groups are analyzed. Then the functionality of Comeks is explained, and the selected design choices regarding functionality are examined. Also the design process of Comeks' user interface, UI's functionality and its hierarchy are explained. Then the application's software implementation and software architecture are explored and finally, the tools and methods used during the implementation are listed.

5.1 Target users

Based on the content creator user groups presented in section 3.5.1, we chose hobbyists for our main target group for our content creation tool. Comeks can make content creation and sharing easier for existing hobby groups. Target users of the application prefer to do something creative, and they are entertained by doing so.

Essential for supporting hobby usage is the web-based user community, where hobbyists could publish their work and discuss and comment on other people's works. Also the ability to download hobby related icon packs to Comeks could enable users to easily use Comeks for various purposes.

Based on the user interviews and studies at the beginning of the project, we created a light-weight version of Alan Cooper's primary persona [20]. Comeks user spectrum is of course a lot wider than just the primary persona, but it was used as a useful tool in the design of user interaction and appearance. Primary persona was created to reflect the most potential user group found

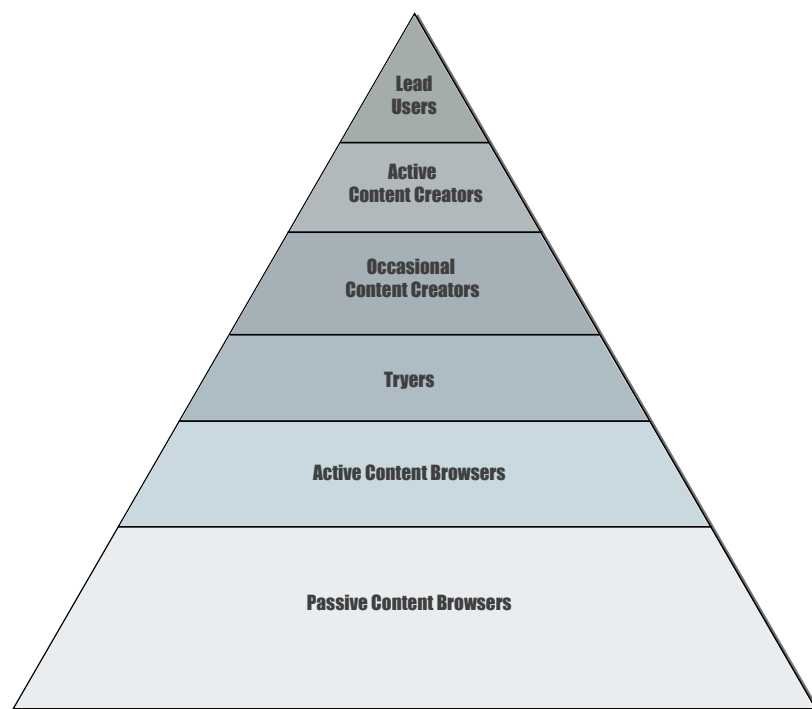


Figure 5.1: User groups based on their activity in the community

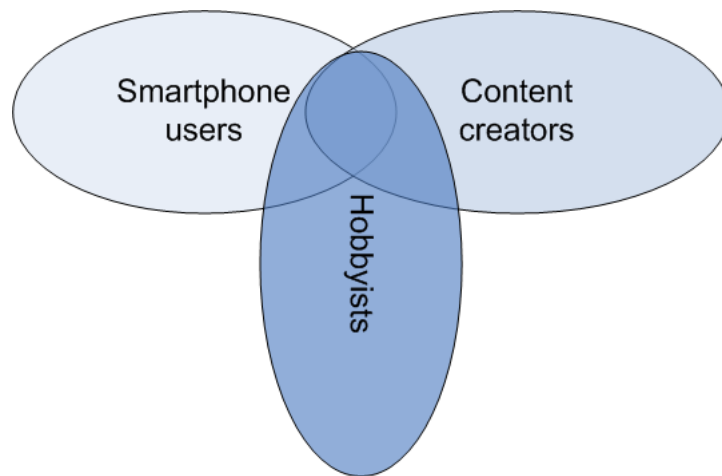


Figure 5.2: Most potential target user group of Comeks

in the intersection of user groups shown in figure 5.2.

Our primary user persona was characterized by:

- 16-26 years old
- Likes video games (especially multiplayer games), but spends more time with user-created content communities such as Flickr and YouTube
- Owns a mobile phone with camera and support for J2Me or Symbian operating system
- Likes playing around with different content production tools, does video or photo editing
- Creates content to support another hobby
- Likes sharing his creations with friends
- Is active in web communities
- Mobile phone is not just a phone for him, but also a toy and a medium for self expression

We also distinguished users by the level of activity they are using Comeks service with (see figure 5.1). As with most user-created content, content creators are just a small portion of the whole audience. There are usually few people who create most of the content and the largest group of users rather

enjoys browsing content created by others. The Comeks mobile application is targeted to content creators, and content browsers are using only Comeks web service (not implemented yet).

Content creators:

- Lead users:
 - Very small percentage of the users
 - Innovative and creative users who invent new ways to use Comeks (e.g. new forms of expression and storytelling or new visual effects)
 - They usually possess artistic or technical talent superior to other users
- Active content creators:
 - Second largest group of content creators
 - Create content actively, yet the artistic or technical quality of the content created is not as high as with lead users
 - Active members of the community, commenting other people's creations
 - Admiring lead users and perhaps wanting to become one
- Occasional content creators:
 - Largest group of content creators
 - Create content once in a while
 - Many occasional content creators are actively participating on other activities of the community (e.g. discussion)
- Tryers
 - Some people who browse other's creations wish to try out creating content by themselves
 - After trying content creation few times some users may become active content creators or some may stop creating more content

Browsers:

- Active content browsers:

- People who visit the web community actively
 - They may participate in discussion and rating other people's works but don't submit their own creations
 - They enjoy the sociability of discussion or they want to have an influence on what content is being shown
- Passive content browsers:
 - People who visit the web community every once in a while
 - They don't participate in any activity of the community

5.2 Functionality

5.2.1 Refining the Comeks concept

At the very beginning of the Comeks project, we carefully analyzed which elements of comics would be meaningful to include, while the complexity of the software would remain reasonable. Also the restrictions of mobile phones (mostly the small screen sizes, and limited interaction mechanisms) caused various limitations to the software.

In the end we decided to include the following elements of the comic vocabulary: user may take photographs to create the basic artwork, add speech bubbles, add different borders to each frame, add comic icons (e.g. sound effects) and of course, add many frames in sequence.

We decided to leave out the ability to create more complex layouts and different frame sizes, since it would be difficult create such complex tasks using such a small screen. Also it would make sharing the strips from one phone to another more difficult, because variable frame sizes would require the receiver to have a dedicated reader software. The final functionality of Comeks is discussed in detail in the section 5.2.2.

When designing the Comeks concept we tried to take into account the special needs for mobile content production tools, which have been presented in the previous chapters.

The following goals were identified for the Comeks application:

- Ease-of-use: Comeks should be easy to use. Anybody should be able to start to use it in five minutes.

- Creative entertainment: The use of Comeks should be entertaining and it should tempt the user to create fun content.
- Easy sharing: The user should be able to share Comic strips easily by using existing messaging technologies.

5.2.2 Functionality in creating a comic strip

Comeks user may add the following elements of comic vocabulary to their comic strips:

Artwork images:

- The user may create the main artwork, representing the visible things, by taking a photograph or by opening an existing image.
- Images can be rotated, scaled, stretched, moved and their depth order may be changed.

Speech bubbles:

- The user may add any number of speech bubbles, move them, change their depth order and change their size.
- Any length of text can be typed inside each speech bubble and the bubble size scales automatically according to text length.
- The shape of the bubble may be chosen from few predefined shapes (round, rectangle and cloudy "thinking bubble").
- Also, the user can move the pointer coming from the speech bubble to point to the direction of the speaker .

Borders:

- Borders can be chosen from various types, shapes and sizes. Some borders may be used to create layout effects discussed in section 4.1.1.
- Borders were decided to include in Comeks concept, even though they are not that important when the strip is viewed merely on the phone screen. However if the strip is printed or viewed on a computer screen the borders become more important for the comic appearance.

Icons:

- The application contains a large library of icon bitmaps, which have transparent background.
- Icons can be rotated, scaled, stretched, moved and their depth order may be changed.

Filters:

- A set of filters may be applied to artwork images and icons. Filters were considered important in order to create more comic-like appearance to images. This also allows the user to create different styles of comics. The filters chosen to be included were the following:
 - Hue: changes the gradation of colors. It can be used to make surreal colors or slight adjustments to the image's colors.
 - Saturation: changes the color richness in the image. By changing saturation it is possible to make black and white images, or use comic-like strong colors.
 - Brightness: makes the image to look either brighter or darker. It can be used to fix errors in lightning (i.e. underexposed photos).
 - Contrast: changes the difference in color and light between parts of an image. By adding more contrast, it's possible to achieve comic-like appearance.
 - Transparency: makes the image (or icon) transparent. It can be used for example to mix and blend two photo shots.

5.2.3 Functionality in publishing & sharing the strips

- Strips may be previewed in full screen prior to publishing
- Strips may be saved in either JPG format, or in proprietary Comeks binary format, which allows to user to edit the strip later on
- The user can share the strips via:
 - MMS
 - E-mail

- Bluetooth
- Infrared
- The image size of the shared strips may chosen to be either large (176x132 pixels) for sharing with S60 phones or to small (128x96 pixels) to be shared with phones with small screens.

5.3 UI Design & implementation

User interface design was done according to the design cycle illustrated in figure 5.3. After the target group definition, a basic set of features was specified. We thought of different possible designs to implement those features and tested those quickly through by using paper prototypes. Finally best design was found, we added some features to design, removed some features and made few small adjustments to the design. Those designs were then tested each round with small group of users by using paper prototypes.

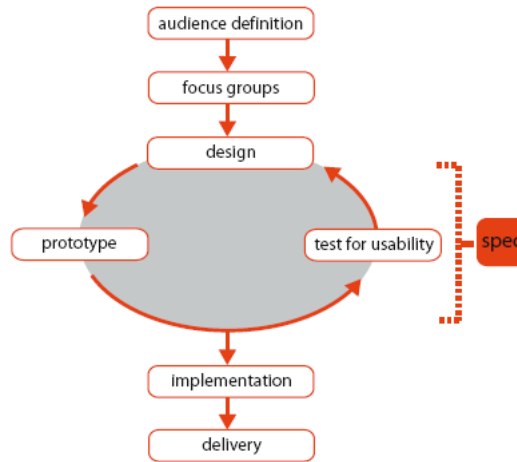


Figure 5.3: UI design cycle [102, p.62]

5.3.1 Interaction mechanisms

Naturally, S60 phones' interaction mechanism (presented in figure 5.4) were taken into account when designing the user interface. Final design (as presented in figure 5.6) was based on using the mobile phone's joystick (i.e. navigation key) to do most of the tasks. Softkey labels are presented in

a standard way, however a center softkey label, familiar from Nokia S40 platform was introduced to indicate the action for pushing the joystick (i.e. selecting).

Due to consistency with other S60 applications, all functions can be done by using application menu, which can be opened by pressing the left softkey. Some tasks, such as previewing and sharing the strip were only put on the application menu. Text to speech bubbles can be added by typing it using 12-key ITU-T keypad. Pushing the right softkey takes the user back to previous level (application's levels are explained in section 5.3.2).

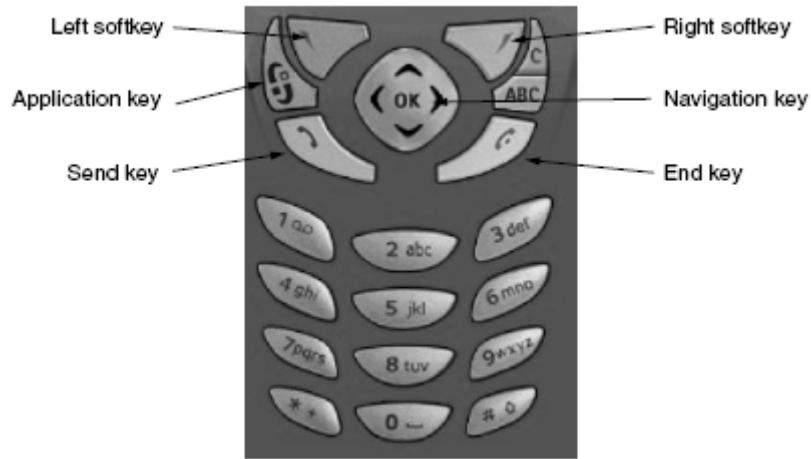


Figure 5.4: S60 interaction mechanisms [25]

5.3.2 Application levels

Due to the complexity of the application, it was necessary to divide the functionality into different levels of subtasks, as shown in figure 5.5. The comic creation logic is split in three main levels: strip level, frame level and item level. Additional fourth level is needed when custom filters are used. On the strip level, the user can see the whole strip, add new frames, remove frames, copy frames and move frame's location in the strip.

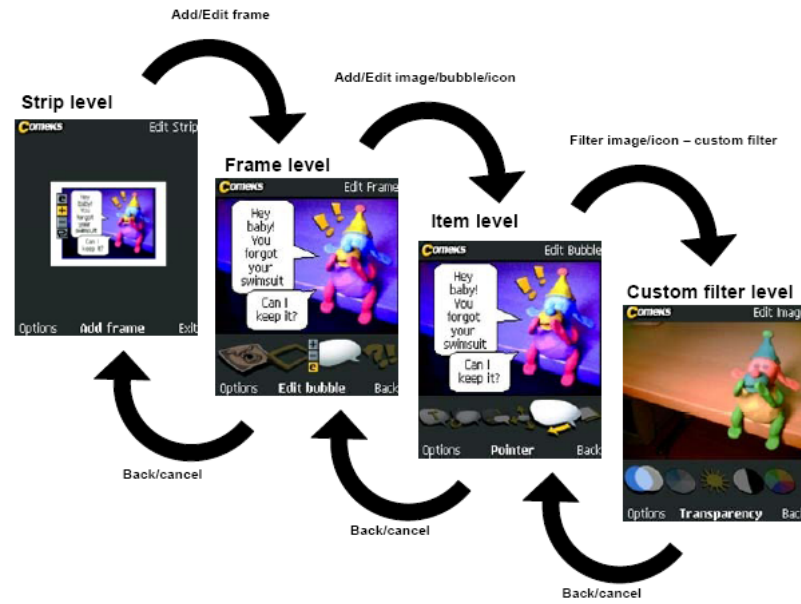


Figure 5.5: Structure of the UI

The frame level is where the user can add all the contents of one frame, such as take pictures and add icons, borders and speech bubbles with text.

On the item level, the user may adjust and edit each item added in one frame. Depending on the item, the user can add text, scale or stretch the item, rotate and move it. Also depth level (i.e. which item is on top) in comparison to other items in the frame may be changed.

5.3.3 Comeks' menu system

Majority of Comeks' functions can be done using the bottom menu of each level, which is operated by using phone's joystick. For example in frame level, pressing joystick left and right switches the editable element (i.e. images, borders, speech bubbles or icons). Pressing joystick up and down switches the operation (i.e. add new, remove element or edit existing). Pushing joystick down selects the currently selected operation. Same logic is used in each level.



Figure 5.6: Final Comeks UI design. Phone image copyright by Nokia.

5.4 Software implementation

5.4.1 Software platform

The first version of Comeks was decided to implement on the S60 version 2nd generation platform, which uses Symbian operating system. This technical design decision was made at very beginning of the development cycle, mostly because we thought that it would be impossible to implement some crucial functions, such as using the phone's camera, using J2ME. Later on, we learned that currently J2ME is capable for implementing all the core functions of Comeks, but low processing power and buggy J2ME implementations are still restricting the full featured use of J2ME to only newer and more expensive mobile phones. However a J2ME version of Comeks is being developed as well as a version for S60 3.x platform.

5.4.2 Software architecture & design

Comeks was designed and implemented using Symbian standards and conventions. Most of the code is related to user interface, but also few modules are related to bitmap operations, camera functionality, data transfer and other application logic. The main classes can be seen in the figure 5.7.

Standard Symbian graphical user interface (GUI) architecture was used in implementing the Comeks' user interface. Hence Comeks follows the MVC (model-view-control) pattern[25, p. 39]:

- model contains program data and modifies it
- view defines how data is presented to the user
- controller defines how to react to user interaction

Each UI level (see section 5.3.2) has its own view, which is separated to View- and Container-classes to follow the Symbian conventions.

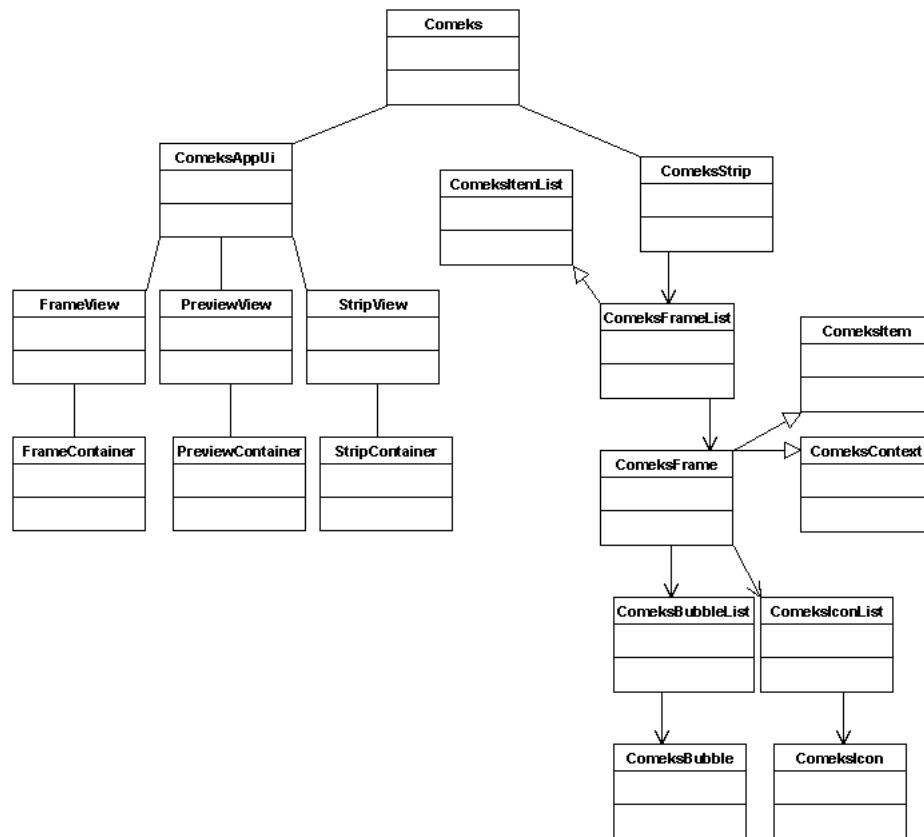


Figure 5.7: Class diagram of the main classes

User interface components

Since Comeks' user interface is highly customized, most of the user interface components were built by us from the very beginning. S60 provided UI components were used only in few cases, such as in the application's main menu (see figure X) and icon selection grid (see figure X).

Each program level has its own view which is taking care of showing the user interface. To implement the bottom menu for each level, a general ComeksMenu-class was created, which is then inherited by menu of each level. See figure X for example of the class hierarchy in strip level.

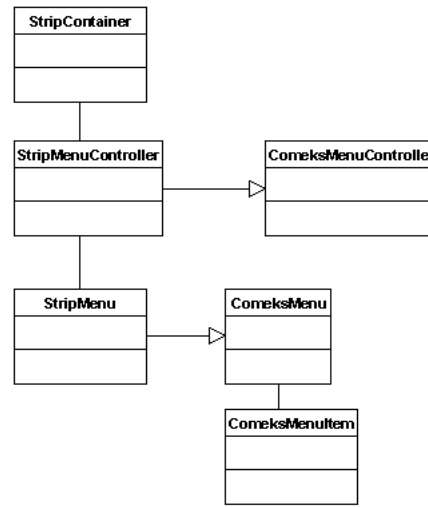


Figure 5.8: Strip level's menu related class structure

Data transfer

For sharing the comic strips, S60 platform's provided communication services were used. Since sending strips to web server was not yet implemented, all forms of sharing were implemented using standard MMS messaging protocol.

Camera functionality

Basic camera functionality was included in Comeks i.e. the user can take pictures within the software (see figure A.5). More advanced camera features introduced in modern mobile phones, such as flash usage, were not yet implemented.

Camera module is based on S60 camera service and event-listener model is used in its interaction between other components. Thus after camera module is started from the frame level, it notifies the container when user taken picture is ready for use.

Bitmap functions

Quite a few bitmap transforming and manipulation related operations were needed in order to create many essential bitmap manipulation functions such as scaling, rotating and filtering of images and icons.

We did research in order to find efficient transforming algorithms suitable for mobile phones' low processing power. Also experiments with different kinds of resampling algorithms were done in order to find the balance between image quality and speed.

5.5 Tools and methods used

The most important tools and methods used during the development process are listed in this section.

UI design :

- paper prototyping & testing with users
- Software: Adobe Illustrator & Photoshop were used to create UI graphics

Software design:

- Software specification: Use case diagrams, class and object diagrams, sequence diagrams
- Software: StarUML

Software implementation:

- Nokia S60 software development kit (SDK) 2nd edition (Feature Pack 2) was used as SDK
- Microsoft Visual Studio 2003 with Nokia Carbide.vs 2.01 was mainly used as our integrated development environment

Testing:

- Unit testing was done throughout the development process
- Application testing was done using Nokia S60 software development kit's S60 emulator and using Nokia 6600, Nokia 3230 and Nokia N70 phones
- UI was tested with heuristic analysis by a 3rd party company (see section 6.1.2)
- The final application was tested against Symbian Signed test criteria by a 3rd party company (see section 6.1.1)

Documenting:

- L^AT_EX & Microsoft Word

Version control:

- CVS was used first but due to its limitations, we changed to Subversion

Chapter 6

Analysis & Future work

6.1 Results from formal tests

6.1.1 Symbian Signed testing

Comeks has passed the Symbian Signed [90] tests run by a 3rd party testing company, which proves that:

- Comeks follows Symbian standards regarding installation and uninstallation
- It has consistent UI
- Can be safely run in mobile environment
- Comeks doesn't affect the use of system features or other applications
- It works as expected in limited memory conditions.
- Comeks can handle exceptional, illegal, or erroneous actions. It does not cause phone to crash or freeze and exits gracefully from any application exceptions likely to crash.
- It handles interruptions, such as incoming phone calls and unexpected reboot correctly

6.1.2 Heuristic analysis of the user interface

In an expert review, experts evaluate whether given product follows usability principles, known as heuristics. This is done by doing walkthroughs, in which attention is paid mostly to main functionality of the system and its significant usability problems. Information is based on experts' knowledge and experience about the common usability issues and their general knowledge about human's perception skills and cognitive behavior. [68]

Its key benefits are that it's a quick, easy and inexpensive way to find significant number of usability problems. Thus heuristic analysis can be a good tool when used in iterative design cycle; however in order to find more usability issues, it should be combined with testing with real users. [68]

Expert review of Comeks' usability was done by Idean Research at the final stage of the development. The review's goal was to find the main usability problems and suggest improvements. In the review, Comeks was found to be interesting, fun and easy-to-use, however few small or moderate usability problems were found.

The most significant usability problem was found to be the transitions between application levels. In the tested version it was difficult to see in which application level the user currently is (see 5.3.2), and the transitions were easily missed. This was fixed as suggested; by adding a title at the top of the screen, which indicates the currently active level.

Also some inconsistencies were found in the navigation, in the use of colors and icons and in the use of softkeys, which were fixed. Some uncommon terminology was also used in some places, which was changed to more standard terms.

Undo functionality and application help were added according to expert review's suggestions. Also few application bugs were found in the review, and they were fixed.

6.2 User feedback

In this section I'll briefly analyze the user feedback received from Comeks users. At the moment of writing, the first version of Comeks application has been publicly available for half a year. Anybody could buy it from the Comeks-dedicated website or from the web shops selling Symbian applications. Thus, we have got some direct feedback from regular users. Most academically valuable data from users was received from user study made by

a HIIT researcher, Antti Salovaara, who studied the use of Comeks as part of his doctoral thesis.

6.2.1 Direct user feedback

The direct user feedback has been collected in brief interviews and user trials, from received e-mails and from several discussion forums and blogs (e.g. [4] and [9]) in the web. In general, the Comeks concept has proven to be very interesting. Users have enjoyed the entertaining use and many have suggested functional uses for it too. It has proved to many skeptical people, that it's possible and meaningful to create content creation tools for mobile phones. Especially the user interface design and usability has received lots of compliments.

However, the following issues have been noted by several users:

- The registration process has caused problems with many users. Comeks uses a 3rd party license manager, which requires the use of Internet to validate the registration by default. Many users don't have correct Internet settings, which is causing the registration process to fail – making many users frustrated. This has been fixed by improving the documentation. We are also planning to remove the 3rd party license manager in the future versions of Comeks.
- Some users are complaining about the lack of sharing possibilities to web. They would like to upload photos to a web server, allowing sharing with larger audiences and discussion around comic strips.
- The amount of supported handsets is currently too low, since only S60 2nd generation handsets are supported.
- Few bugs related to saving and user interface in some handsets were notified by users, and then fixed.

6.2.2 HIIT user trial

Antti Salovaara, a HIIT researcher and a doctoral student, did a field trial with a group of 8 Finnish high school students, where they used Comeks for two months period in December 2005 - February 2006. During the user study, 89 Comeks created strips were sent.

In Salovaara's study, he was analyzing how usage patterns evolve in social interaction, when the interaction is mediated through technology. He studied how functionality can be designed to support the following three ways of appropriations: technical mastery, re-channeling existing communication to new medium, and inventing new communicative acts between users.

Salovaara noted that there was a lot of variation in the use of Comeks between different users. As expected, some users were very active in using Comeks and some users had critical attitude about the system, and were not so interested in using it. In his study, the biggest differences in the use of Comeks can be examined by looking the use of following four different types of users.

Advanced user

One user was very interested in exploring the image processing capabilities of Comeks and not so interested in using it in social communication. He was keen to explore the possibilities in using the filters, different bubble styles, zooming possibilities and other advanced features. His strips were more artistic and fictitious stories, rather than trying to communicate a specific functional message or do social interaction.

This advanced user liked to share the strips by showing his phone to friends. He was also interested in collaborative messages and letting others participate in the message creation process.

Active user

The most active user sent 34 messages created with Comeks. She was mainly interested in creating and sharing narrative stories about everyday situations.

Being the most active user, she faced the common problem related with MMS messaging – she became frustrated about other people not answering to her messages. The users found it difficult to answer to well created MMS message, and felt that they had to create something equal in return, but often didn't have the skills or the time to do so.

This problem was probably one of the reasons that towards the end of the study, her messages got shorter and less narrative and fictitious. The messages started to be more mundane communication, containing mainly greetings and expressions thoughts and moods. This kind of messages were created on the spot and shared immediately, without spending much time in planning the strip's contents.

Critical user

One user developed a critical opinion about the Comeks' usefulness, and as a result, he sent very few messages during the trial. He became frustrated

when he noticed that replying to other users' messages was difficult, because of the need of some kind of idea and visual content.

He also expressed that he didn't liked being photographed and that message creation with Comeks was too slow for him. It was difficult for him to turn everyday happenings into comic strips, and he didn't often have anything particular to tell to others with comic format.

Practical user

In the study, Comeks was also used for practical purposes. One active user, who was previously familiar with using MMS, used Comeks mainly as a substitute for mobile phone's MMS editor. She sent messages mainly to her friends, instead of other users in the study.

Her messages were often greetings, replies and spontaneous thoughts, but she also used Comeks in arranging practicalities. She was not so interested in comic-like storytelling; instead she squeezed the images and added lots of text around the picture.

Comeks' appropriations

As a conclusion, Comeks was observed to successfully allow users to appropriate it in many different ways. Comeks offered enough possibilities in exploration, allowing many different forms of visual outcomes. Each user developed their own style of expression and communication, which was often related to the technical skills of the user.

Comeks also successfully allowed the channeling of existing communication into new medium. It was noted to have enough overlap with the existing technology and old media; still providing new features and forms of expression as well.

Finally, Comeks was successfully used in inventing new kinds of communicative acts. The variety of different expression styles showed that Comeks can be used in flexible ways, depending on each user's needs. Bringing the comic-style form of communication (for example by blurring the boundaries between images and text) into mobile platform was showed to provide resources for communication that were not possible by using previous systems.

Issues and request found in the study

The following main issues and users' requests were found during the field trial:

- MMS was not considered the best possible way to share and reply to comic strips. The users wanted to use more instant messaging style

communication, where strips could be shared to number of people at time, and the receivers could easily comment the strips and see other's comments. Thus, the encouraging different forms of replying needs to improved, as well as the awareness of others' messaging.

- Save functionality is cumbersome and hidden in the application menu. Some users didn't realize that it even exists.
- When taking a photo inside Comeks application, the image is not saved in the mobile phone's gallery. Some users requested this feature, so that the same image could be easily used in various comic strips.
- Users were mostly using the custom filter functionality, and wished to have quicker access to it. The use of filter slider was also noted to be too slow (when using Nokia 6600 phones), since it calculates the filter effect in real-time.
- New features were requested: different fonts and colors, image cropping possibility and partially transparent speech bubbles. More comic icons were also requested

6.3 Future work

Bulbon Oy is currently looking for venture capital to continue the development of Comeks. The future development threads are introduced in the following subsections.

6.3.1 Porting Comeks to J2Me

Comeks will be ported to run on most modern J2ME-enabled phones. The feature set will be mostly the same as in S60 version; however few minor adjustments are done to the user interface to deal with smaller screen sizes.

MMS sharing will not be supported in the J2ME version in the near future, since only few current handsets support WMAPI 2.0 (JSR 205), which enables sending MMS using J2ME. This APIs functionality could be implemented programmatically using HTTP and dedicated MMS sending server, however access to the handset's phone book is not possible without support for WMAPI 2.0. Instead, sharing is implemented using web upload and e-mail.

A 95 % working J2ME version is already implemented to run on new Nokia S40 phones. This version needs to be finalized and ported to other manufacturers' platforms.

6.3.2 Porting Comeks to S60 3.x phones

Migrating from S60 2.x platform to S60 3rd Edition requires a significant amount of development, since S60 3rd edition is based on Symbian OS v9.1, instead of v7.x or v8.x used in S60 2.x; causing a binary break between those platforms. The main differences between the platforms are changes in many APIs and file locations, new compiler, new improved application security model and new signing process.

Otherwise S60 3rd edition offers just additional and enhanced functionality. Significant new features implemented in Comeks 3rd edition version is the support for vector images (SVG format) and support for different screen sizes. By using vector images it is possible to have scalable UI, and support scaling of icons better, without the loss of quality. The implementation of Comeks 3rd edition version is currently almost done.

6.3.3 Creating a web-based community

The largest and most significant development thread is to create a web-based community around Comeks. Web community's purpose is to offer the users the following functionality:

- Improved possibilities in sharing the comic strips: direct upload from mobile client to a server
- Possibility to comment and rate other users' creations and socialize in other ways
- Offer supplies of add-ons (new icons, bubble styles, filters, etc.)
- Tools for users to create their own add-ons
- Comic subscription services

Web community development is currently at design phase.

6.3.4 New features

The following new features are planned to be implemented in Comeks in the near future:

- Better way to share comic strips from phone-to-phone is implemented by allowing the user to upload strips to web community. The users may then send SMS links to other users, allowing them to view and comment shared comic strips in a mobile browser or in dedicated viewer software.
- New application level, which offers shortcuts to most common functions such as previewing, saving and sending strips.
- Saving Comeks taken pictures into mobile phone's gallery.
- New bubble styles, which allow different fonts, colors and different levels of transparency.
- New icons with different themes.

6.3.5 Fixing issues found

The following issues found in the user studies are planned to be fixed:

- Improving save functionality, by adding a shortcut to it (see 6.3.4) and by improving the general usability of saving.
- Fixing a lag in real-time filter rendering. This is done by improving filter algorithms or by removing real-time rendering.
- Moving custom filter selection into default option in the filter dialog.
- Fixing few bugs.
- Optimizing the speed of image manipulation operations, application loading, loading of saved strips and the transitions between application levels.

6.3.6 Improvements in marketing and in the business model

The business model of selling the Comeks application (current price 8,90 EUR) hasn't proven to be very successful. It seems that people are not yet ready to pay such high price for entertainment mobile applications. Also, even though Comeks had a 3rd party copy protection, it was cracked during the day of publication, so most of the users are illegal users.

In the future the plan is to offer the basic application for free and charge for extra content, such as icon packs and subscribed content. Additional income is planned to get from advertising and partnering.

In order to get more users, marketing needs to be improved. The plan is to concentrate on viral marketing through blogs, social networking applications and discussion groups; however campaigns to offer externally branded versions (created by media corporations) of Comeks are also planned, as well as co-operation with telecom operators and phone manufacturers.

Chapter 7

Conclusions

The aim of this thesis was to examine the current state of user-created content and to study how to create content creation tools for average mobile users.

The thesis started with the literature review related to user-created content. The basics of UCC were explained; such as the biggest differences between UCC and broadcasted content and the users' motivations for creating content. The most notable difference was identified to be related to the production process, since UCC is created by average users with various levels of skills, leading into heterogeneous quality of the content. Content wise, UCC was noted to be more personal and related to interpersonal communication.

Also the distribution and consumption process of UCC is different from mass media. In UCC, content is often distributed in UCC communities connecting peers interested in the same subject. The consumption is more active process with UCC, since it often involves active discussion and collaboration, blurring the boundary between content producer and consumer.

By introducing new forms of interaction, UCC can allow the people to communicate better. UCC also offers more unrestricted channel to distribute information, making it possible to offer more democratic and more up-to-date content than with broadcast media. Also by making content creation easier, new UCC technologies are making people to utilize and explore their creativity more.

In the analysis of current examples of UCC, different forms of creating content were explored, and their motivations were studied. As the popularity of social networking applications and blogs show, the most common reasons to create and share content are related to social interaction between people.

Most current mobile UCC examples are related to camera usage, and sharing

either from the phone's screen or through messaging is an important motivation to create mobile content. The mobile UCC is often more mundane and emotional due to ubiquity of the mobile phones. The ubiquity also introduces new and convenient ways to use UCC in social communication.

The literature analysis was applied into practice, when a mobile content creation tool for creating comics was created. The comic-style storytelling was perceived to be well suited for mobile environment and it was noted to have many value adding possibilities in person-to-person communication.

7.1 Experience gained

During the Comeks project, the project group's skills and knowledge in creating mobile content creation tools have evolved from zero level into being experts in the field.

In the beginning of the project, the project group had no previous experience in mobile development, so everything had to be learned from the beginning. We were expecting more difficulties and delays that we actually experienced. However, especially with Symbian development, the available documentation was noted to be rather poor; and learning curve was quite high – and significant amount of time was wasted in learning how to do many simple things.

During the design and implementation phase of the comic strip creator, the project group became accustomed with the various usability and technical restrictions of the mobile phones, and the main findings were presented in the thesis. Most notable finding was that mobile applications need more resources and time to develop than desktop applications. The usability has to be designed more carefully, and due to the device fragmentation, testing is a time consuming process. Also device restrictions such as low memory and processing power caused many delays in the development.

7.2 Discussion

Even though a significant amount of research about UCC has been analyzed in this thesis, it is by no means the definitive study in mobile content creation. UCC is still a relatively new and quite unexplored phenomenon; therefore most research presented was quite qualitative, lacking the deeper analysis of psychology, sociology and the demographics of the users.

Especially very few studies are available about the specific details of mobile UCC, making it difficult to examine the phenomenon as a whole; for that reason research presented in the thesis was centered around camera usage and mobile messaging. Comparing Comeks to other solutions is also tricky since there are only few advanced content creation tools for mobile phones, and none have succeeded in getting mass adoption nor have their usage patterns been studied.

Since the aim of this thesis was to study user-created content from the multi-disciplinary point of view, some topics had less attention than they deserve. Especially the usability and the technical implementation of mobile UCC tools could deserve a thesis on their own.

In order to further deepen this research, issues found in the user studies should be fixed and larger scale user studies should be conducted. Also when Comeks can be used in sharing comics through a web community, the intersection of mobile UCC and web communities should provide an interesting perspective to the user studies.

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Appendix A

Storyboard for creating comics with Comeks

When Comeks application is started, the user may choose to resume last strip, which is always automatically saved when exiting Comeks. Other option is to create a new empty strip.



Figure A.1: Startup screen of Comeks

After creating a new comic strip, Comeks starts in the empty strip level. The user may create the first frame by selecting "Add new Frame" by pressing the joystick down. The middle soft key label ("Add frame" in figure A.2) always

refers to pressing the 5-way joystick down.

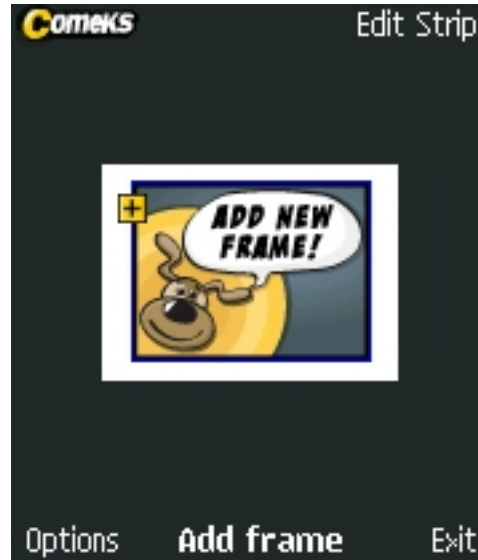


Figure A.2: Empty strip level

Adding a new frame takes the user to the frame level. On the frame level the user can start adding different media elements: images, borders, speech bubbles and icons.

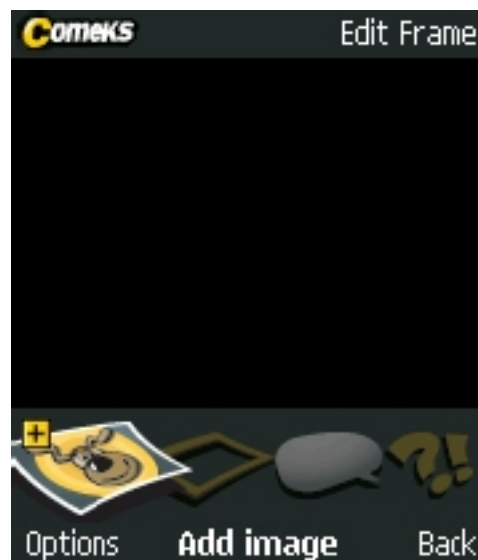


Figure A.3: Frame level

The user may add images to the comic frame by taking pictures with the mobile phone's camera or by opening existing images.

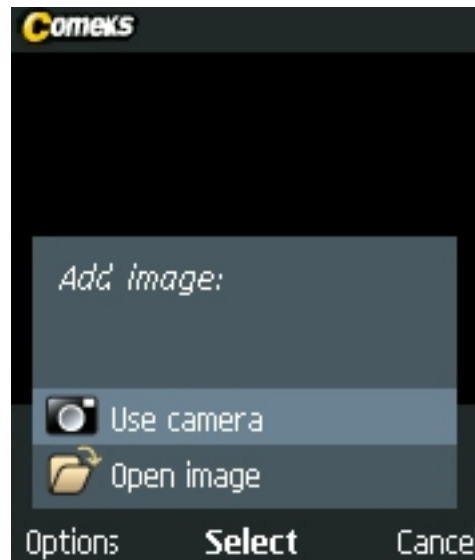


Figure A.4: Adding image

When taking a picture, camera view port becomes visible inside the application and the user may take the picture by pushing joystick.

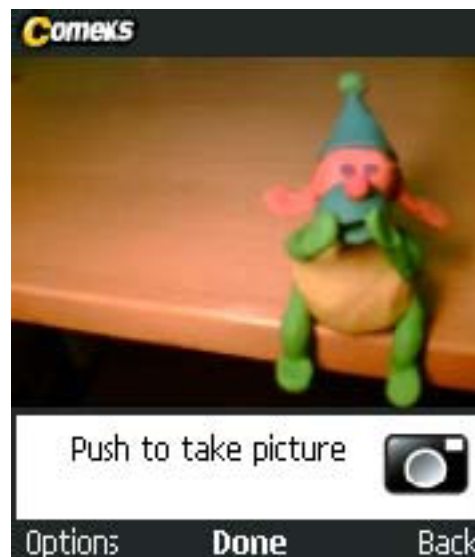


Figure A.5: Taking a picture

After picture is taken, it may be adjusted in various ways. The user may select a tool from Scale, Stretch, Move, Rotate, Filter and Depth order with the joystick (left/right) and activate the tool by pushing the joystick down.

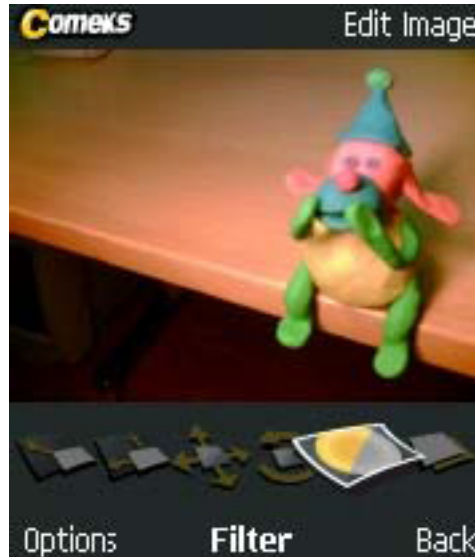


Figure A.6: Image editing possibilities

In the filter function, the user can adjust the image in many ways. He may choose to use a filter preset or use custom settings, where hue, saturation, lightness and transparency may be adjusted separately.

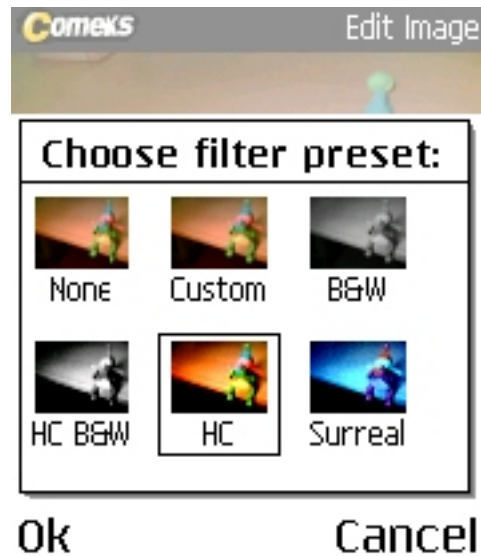


Figure A.7: Selecting filter type

The user may add bubbles by selecting the bubble function in the frame level.

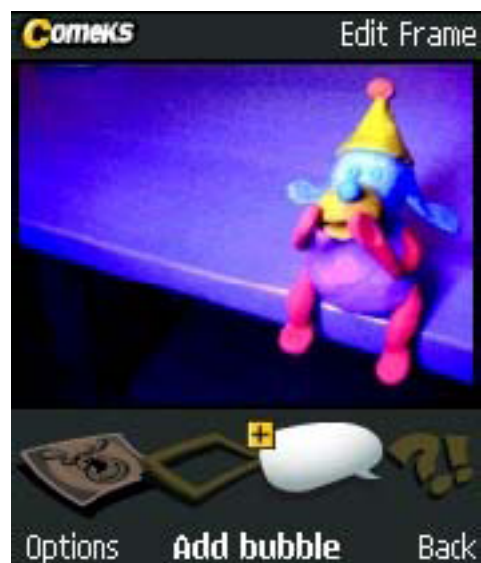


Figure A.8: Adding bubbles

Activating "Add bubble" takes the user to the "Edit Bubble"-level. Here the bubble can be edited by selecting from the following tools: Text, Style, Stretch, Move, Pointer and Depth order.

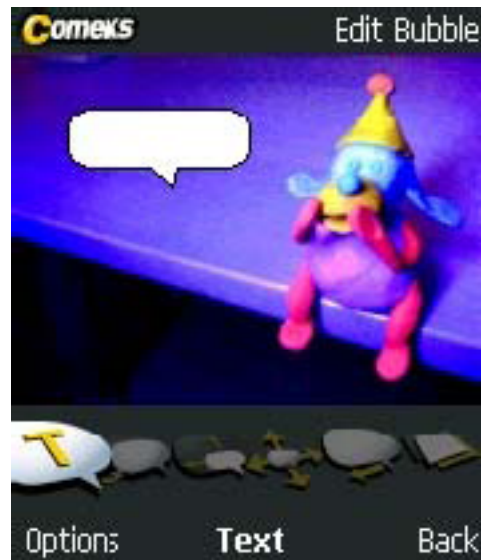


Figure A.9: Editing bubble

After editing the bubble text and choosing bubble's style, position and size, the user can move the bubble's pointer to the direction of the speaker.



Figure A.10: Moving the pointer

Icons and symbols can be added to a frame by selecting "Add icon" on the frame level.



Figure A.11: Adding icons

Icons may be choosed from the extendable icon library.



Figure A.12: Choosing the icon

The icons can be adjusted just like camera phone images.



Figure A.13: Selecting icon

After adding other elements, the user may add borders to the frame.



Figure A.14: Adding borders

Borders are chosen from presets in the menu.



Figure A.15: Choosing border type

In the strip level, the user may edit frames (e), add frames (+), remove frame (-), copy frames (rectangle symbol) and if there are more than one frame, move frames (Arrow symbol).

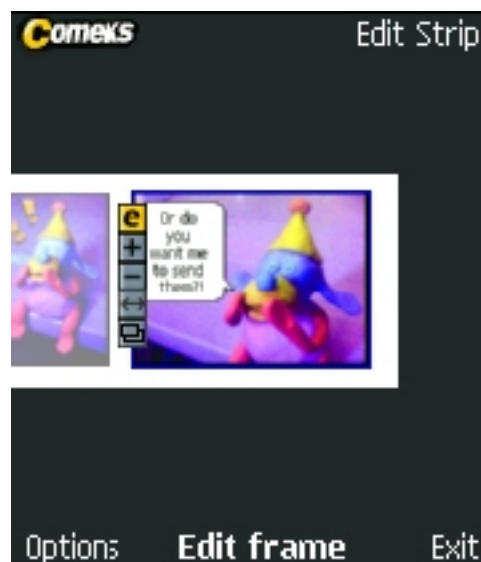


Figure A.16: Frame level

When the strip is finished, the user may preview the strip in full screen, and

change the active frame using joystick (left/right).

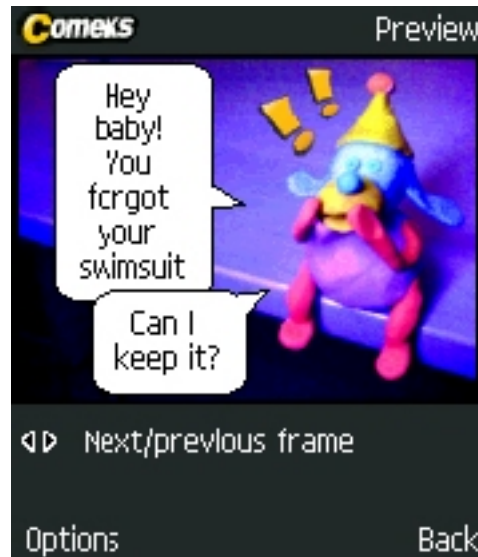


Figure A.17: Previewing the strip

Finalized strips may be saved in Comeks binary format or as JPEG images.



Figure A.18: Saving possibilities

Strips can also be shared by sending them via MMS, e-mail, Bluetooth or

infrared.



Figure A.19: Sharing possibilities