HCI Aspects of Social Media in Collaboration of Software Developers*

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While collaborating using social networks, software developers are stimulated not only to consume content but to create it as well. Software developers are often geographically dispersed and therefore work in different time zones. Besides collaborating using standard means of communication they are often engaged in a very interactive process involving not only their immediate colleagues but also other members of social networks as well. HCI aspects of social media in collaborating environments are still to be explored. Latest mobile devices (smart phones and tablets) with high-resolution displays and impressive specifications offer possibilities for HCI change when it comes to social media and Web 2.0 applications. Software developers began using forums then Wikis and now are relying more and more on micro-blogging and social networks. They are stimulated to consume as well as create new content and their status changes when they solve problems and help others.

Keywords: HCI; social media; collaboration; wiki

1. Introduction

It would be unimaginable to realize everyday information flow without the social media. We started with enthusiasts modem-dialing various bulletin board systems and eventually switching to static web. Web pages first encountered the era of text combined with a couple of images, then heavy multimedia, coming naturally with higher bandwidth speeds. Technologies like Macromedia Flash (now Adobe), Apple Quick Time, changed the way we perceive online content. All of a sudden it was more about multimedia than information itself. As the initial hype with heavy content decreased Web 2.0 slowly made its way. Today's Internet as we know it is an evolution of different technologies that have or have not been as successful as planned. The best example is mentioned Flash, at some point it was so popular that even the navigation on the web sites used it so frequently. Browsing the online content on mobile phones has changed this approach so it is rarely used today. After recent struggle Apple vs. Adobe, and iOS devices not supporting it, the shift towards HTML 5 is imminent. Cloud services and social network are becoming widespread and used for collaboration. Rapid innovation in telecommunication terminal equipment results in impressive mobile devices that are accessible for anyone. We focus on human computer interaction (HCI) aspects of social media during the collaboration process of software developers.

2. Collaboration and social networks

Social media is what crucially changed the way we exchange information every day. We cannot ignore the current trends so when a person wakes up in the morning, first thing will be to unplug the charger, check the Facebook and Twitter timelines. As soon as they head out of the house they will start checking in at various places using Foursquare, taking pictures and sharing them via Instagram. Of course the media itself may vary throughout the different regions (e.g. VKontakte is the most popular social network in Russia).

Instead of purchasing points of interest (POI) and information databases, users themselves keep it accurate, in terms of geographical location, pictures, links and tips. Since using social media for all kinds of information flow is the *defacto* standard these days, it is inevitable that it is being used in enterprise environments as well.

As we elaborated in [1] many companies didn't have any view on whether employees should or should not use them during work hours. After some time it was recognized as a "time waster" but nowadays many companies actually encourage the use of social media for business purposes. The advantages are numerous and include:

- Building the network of available connections beyond the company,
- In many cases help or idea were received by a person that is not an employee,
- Promoting the company's product or service to journalists and social media contacts is an excel-

lent, way of sending first-hand valid information that can help to promote the company,

- By implementing access lists social networks can be used in an enterprise environment.

One of the major concerns was of course security and information leaks. However, sensitive data will always remain protected but this does not mean that normal communication cannot happen in the cloud. Even now, companies are relying on Dropbox, Skydrive, Google Drive or iCloud to exchange large documents. They can always be encrypted with a strong password. For instance, this paper was written using Google Docs with real time collaboration.

Large enterprises might choose another option – to implement their own social network that can connect to public ones. Such an example is IBM Beehive, which relies on a huge employee base of this company so it has enough man-power to stay internal but still helpful. However for SMBs (small and medium business) there is no point in purchasing or in-house developing such a solution.

Web 2.0 brought many advantages of collaborative work and one of the best examples is Wiki. Besides world famous Wikipedia that relies on this system we can often see it running in companies, providing simple and efficient way of exchanging information and acting as a tool for sharing knowledge and ideas, but solving problems as well.

In our study [2] we have investigated how a software development company uses Wiki in everyday communication. Our analysis consisted of interviewing the management, acquiring the data on usage statistics from the company Wiki and distributing a questionnaire in order to acquire user feedback.

The results were quite promising, although in some areas (e.g. software development lifecycle) we expected stronger applicability of Wiki, in most areas we found significant positive results. By analyzing some of the answers on open questions in our questionnaire, we concluded that employees require better categorization in order to get appropriate information. This is why introduction of semantics would benefit knowledge exchange and informal learning.

There has been a lot of debate whether Social web sites should be used during work hours and how they would affect work performance [3]. Raeth et al. propose that Social Web Site usage impacts individual and team performance positively through its improved structural capabilities. Weak ties are strengthened and individuals can find potential ties through expert search, additionally bridging weak or strong ties of their own social network.

Some authors emphasize the importance of tools used to join groups across different social communities [4] combining more services without the need to create own accounts on social networks. Others provide Social network methodology for facilitating informal learning in organizations [5]. Having classification of social networks in mind [6] software developers collaborate not only using ego-centered social networks (like Facebook or LinkedIn) but especially object centered (like Delicious of Slide-Share). Regardless of the fact which devices will participants in the collaboration process use (web, smartphone, tablet) social media represents a major role in development process. This paper focuses on HCI aspects of social media during the collaboration.

3. Mobile devices and HCI

Due to the increasing market share of smart phones, many companies use them during collaboration. Most widely used platforms are: Android, iOS, Windows Phone, Blackberry OS. Although there are pros and cons for collaboration use for each of them, they all offer enough flexibility and required security to be appropriate for company use in collaboration. Some have the concept of being locked; others are relatively open but offer 3rd party solutions for company use. We can recognize a shift from traditional view that Blackberry is the preferred business platform towards the support for the ones that have largest audience. So far most collaboration solutions that have mobile components support Android and iOS and there is a good chance that Windows Phone will join them soon.

Mobile devices have great potential for the implementation of CSCW (Computer Supported Collaborative Workspace) systems. One of the most important advantages of using this technology is the possibility of interconnecting different collaboration environments. The basic requirements of such collaborative environments are primary media functions. Today's mobile devices, besides basic phone functions, support more and more multimedia applications. They are equipped with different sensors, GSP, high resolution cameras (front and back), and have significantly large memory capacity (up to 64GB). Operating systems that run them and the collection of available applications make them very relevant when it comes to HCI. User can rely on standard services (e-mail, web, instant messaging) but advanced ones as well (virtual whiteboard sharing, augmented reality).

Augmented reality applications take advantage of built-in sensors (GPS, 3G/WiFi, accelerometer, gyroscope, digital compass) and combine real world as seen through camera lens on a screen of a mobile

device with additional information downloaded from a data source (Fig. 1).

At the moment augmented reality is used for applications that enable users to explore and interact with objects around them (Fig. 2). However, in the future they will be used to access different services including social networks.

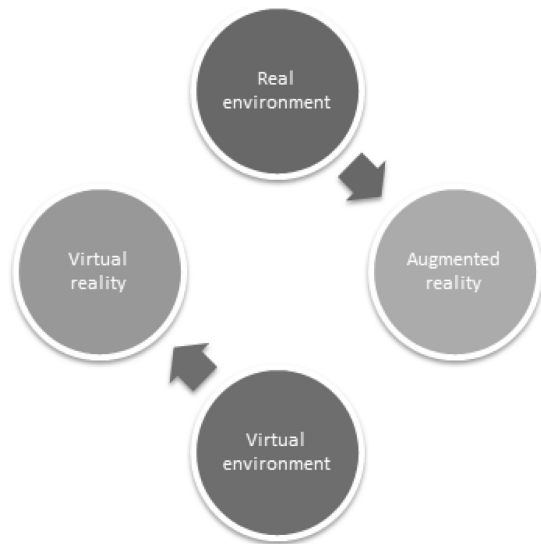Over the last two years screen size on smart
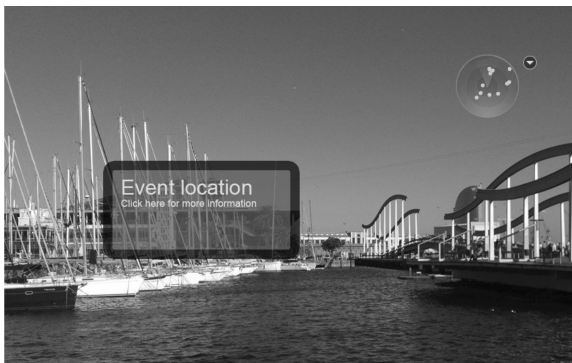

Fig. 1. Augmented reality.

Fig. 2. Augmented reality application view.

phones increased rapidly and tablet devices became widespread as well. It is now considered as standard that smart phone screen size is from 3.5 to 5.5 inches. Beside screen size resolutions are increased as well: smart phones have up to 1280×720 and Tablets up to 2048×1536 pixels. High PPI (Pixel per Inch) ratio enables web based as well as collaboration with native mobile applications (Table 1). All mid and high end devices are equipped with back and front cameras so interaction can be done using video.

Technology for HCI on the mobile devices is at peak, most devices support multi-touch controls and gestures taking interactivity to the next level. What was once part of science fiction movies is already in use at homes. Many collaboration solutions are still not using the possible technologies and we can expect that the usability level can become much higher in the near future. Use case scenarios vary: from interactive whiteboard sharing to video conferencing and real time collaboration on documents. Widespread of mobile devices will enforce leading manufacturers of collaborative solutions to improve HCI using tablet devices. Company policies often include BYOD (Bring Your Own Device) concept so personal devices can be included as well.

4. Human computer interaction and social media aspects

Regarding the intensity of use, the number of users and different end-user devices, aspect of the interaction for collaboration through social media is of great importance. Human computer interaction is considered to be the discipline that deals with interactive computer systems. At the beginning the main interest of human computer interaction (HCI) has been user interface design, but nowadays the interest moves toward anything related to how humans use or are affected by computing technologies. In the 1970s the first users of computers were information technology professionals and dedicated hobbyists [7]. According to Canny [8], rise in

Table 1. Overview of PPI ratios in actual high-resolution mobile devices

Device name	Type	Hor. rez. (pixels)	Vert. rez. (pixels)	Screen size (″)	PPI
HTC Droid DNA	smartphone	1920	1080	5	440
Windows Phone 8X by HTC	smartphone	1280	720	4.3	342
Apple iPhone 5	smartphone	1138	640	4	326
HTC One X+	smartphone	1280	720	4.7	312
Samsung Galaxy S3	smartphone	1280	720	4.8	306
Google Nexus 10	tablet	2560	1500	10.1	291
Apple iPad (2012)	tablet	2048	1536	9.7	264
Apple Macbook Pro Retina 13″	notebook	2560	1600	13	226
Apple Macbook Pro Retina 15″	notebook	2880	1800	15	220
Google Nexus 7	tablet	1280	720	7	210
Apple iPad mini (2012)	tablet	1024	768	7.9	162

popular computing launched with the WIMP (windows, icons, mouse, and pointer) interface influenced that the role of HCI has increased. Popular computing and WIMP made computers usable by everyone, and that was trigger for increased use of HCI. In present times PCs are everywhere, in our homes, in offices, they are even mobile today. And new devices, like smartphones, tablets, smart TVs that are around us, need user-centered interface design. HCI is responsible for all those different interactive systems.

A definition says that HCI is "a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them." [9]. Dix et al. [10] explain HCI as "design, implementation and evaluation of interactive systems in the context of the user's task and work."

The main components of HCI are user, computer and interaction, as presented in Dix et al. [10] textbook:

> By user we may mean an individual user, a group of users working together, or a sequence of users in an organization, each dealing with some part of the task or process. The user is whoever is trying to get the job done using the technology. By computer we mean any technology ranging from the general desktop computer to a large-scale computer system, a process control system or an embedded system. The system may include non-computerized parts, including other people. By interaction we mean any communication between a user and computer, be it direct or indirect... The important thing is that the user is interacting with the computer in order to accomplish something.

But a question is what will HCI, computer, user, and interaction look like in the future. Future interfaces will be context-aware and perceptual [8]. Context-awareness means a kind of cues interpretation in order to figure out what user wants. Three types of context are fundamental for those new interfaces: immediate context, context that represent particular user and others (around him) history, and context that is connected with behavior in particular situation. But many of these cues require machine perception. Besides interface, technologies like flexible displays, new forms of mobile interaction, robots and autonomous machines that can learn will be our usual surrounding [17]. Our lives will change too, in a way we learn, we live family life, and we grow older [17]. Changes in computers, individual life and society will affect our interaction with computers.

All those changes have influenced the way we design interactive systems. Conventional user centered design model follows four basic processes: study, design, build, and evaluate [17]. A new extended approach has additional stage, understanding stage, at the beginning of the process.

The goal of understanding phase is to enable human values to be integrated into the process. But at the end of last decade rose a new discipline social computing. By Wang et al. social computing is computational facilitation of social studies and human social dynamics as well as design and use of ICT technologies that consider social software [18]. Social computing has for main areas of application: Web 2.0 services and tools; entertainment software that can interact with human users; business and public sector which include e-business, healthcare, economic, political and digital government systems; predictive systems for planning, evaluation, and training in different areas. It is important to mention that social computing has emphasized incorporation of social theories and practice into ICT development.

Software developers were using intranet/intranet forums and local IM applications for chat. After the Web 2.0 new set of services became available to anyone, regardless of the size of organization. Company Wikis were the best example [2], and having in mind the nature of the users (developers) quickly more and more of them started relying on online content. Instead of searching online for best practices and problem solving tips they could finally rely on internal resources as well. Of course, the prerequisite was that they were stimulated and interested in creating new content not only consuming it. Since environments like Wiki are not a very fun place to hang out at, next step were public Social networks and Blogs. Nowadays even the giants like Facebook (Worldwide) and VKontakte (Russia) have mechanisms to keep certain discussions private among the users with the right privileges. HCI changed, and is now shifting the paradigm of online presence. It is not just a matter of finding the right information it gives status as well. Software developers build morale and their status by helping others so more and more issues and problem solving techniques are shared. They all experience social networks in a different way. Some prefer micro-blogging with Twitter, others combine work and personal contacts when interacting (Facebook).

5. Proposed method to improve interaction during collaboration

While collaborating using social networks, software developers are stimulated not only to consume content but to create it as well. Web 2.0 focuses primarily on content creation and social networks facilitate such a trend. Instead of using static bookmarks they are dynamic, their links and relationship both with other employees but their friends as well can contribute in problem solving. All the created content is easily accessible and can be found via
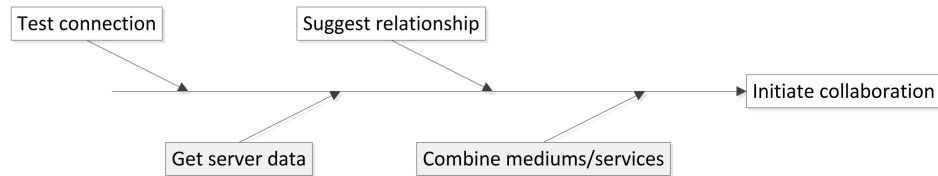
Fig. 3. Improving HCI methodology during collaboration.

search option. Usually there are two approaches: use one of the public social networks with customized lists and user restrictions (e.g. Facebook) or closed Web 2.0 based solutions that can be used on the company intranet. In the first case HCI is very straightforward and combines public and restricted access; one of the examples is the problem solving which is not project related but can be treated as a general one - all the friends and friends of friends can contribute to the solution. In combination with lists with limited access participants can use the tools they generally use every day (translate, YouTube, applications that are specific to a particular social network). That way, if the problem arises again, or a member of a team wants to document the lessons learned, or informs new colleagues on past issues it can be easily done by reviewing that content. In that way non-formal approach in learning and knowledge sharing is used in a best way. On top of this, by expanding a list of contacts beyond an organization the chances the problem will be solved are higher. The other approach is to use local social network, which only selected users (usually employees) can access. HCI is not as rich and is based on Wiki-like content and comments and user interface is similar to online-forums.

Although during collaboration, software developers use different services (e-mail, IM, social networks, hardware/software teleconferencing solutions) usually there are no strict rules or templates on how and when should they use which one or combine social networks with different mediums. They rely on their own intuition or simply use what others seem to be using at that moment.

Our proposal is to take a systematic approach, with initial steps that will occur before collaboration (Fig. 3). First step would be to test network connection. Since usability of collaboration services directly depends on available network speed and stability, it's necessary to consider connection availability, especially if user will participate using a mobile device. We use Android application developed by Savkovic for that purpose (Fig. 4). Mobile application collaborates with server, in order to perform performance tests. After gathering results, send them to the server. After that, an algorithm is executed, which analyze gathered data in order to suggest which combination of collaboration ser-
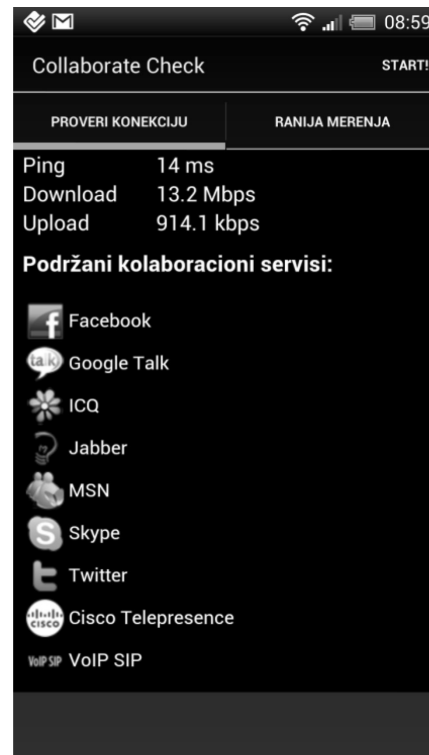

Fig. 4. Android client application.

vices can be used at the moment. Results are sent back and shown in client application (Fig. 4).

Next step would be to include requirements of the relationships between collaborators, together with physical connection parameters, and expand the algorithm, in order to suggest most efficient way of collaboration for given situation.

6. Conclusions and future work

Software developers are often geographically dispersed and therefore work in different time zones. Besides collaborating using standard means of communication they are often engaged in a very interactive process involving not only their immediate colleagues but also other members of social networks as well. HCI aspects of social media in collaborating environments are still to be explored. A lot of challenges may arise in terms of technology to support interaction and collaboration. Numerous solutions are available on the market as we

discussed in [1] but methodology for their use is not yet defined.

Our future work will be to propose an improvement of methodology of development and use of collaboration systems, combining physical parameters of the connection (for instance bandwidth and response times) and requirements of the relationships and ties between the collaborators, in order to suggest most efficient way of collaboration for given situation.

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