

Integrating Comments in Video Tutorials

by

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Abstract

Video tutorials are a popular medium for learning to perform different tasks in feature-rich software applications. In existing systems, the comments are generally shown below the video in threads. This separation of video and comments creates cognitive load when users try to link comments with the video. We designed and developed ‘VidComm’, a prototype interface enabling users to filter comments from different categories and link them directly to the tutorial content and thus enhancing the existing video tutorial comment system. An evaluation of VidComm suggests that this system helps users find particular information from comments more quickly and accurately than a traditional commenting system.

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To my parents and my sister

Chapter 1

Introduction

Nowadays, video tutorials have become an effective medium to instruct viewers who want to gather step-by-step directions to accomplish tasks [40]. YouTube, one of the most popular video sharing sites, has more than one million video tutorials on Adobe Photoshop and over 400,000 video tutorials for Microsoft Word. These video tutorials are watched by millions of viewers [26]. For example, a tutorial on skin retouching in Photoshop¹ was watched more than a million times and a YouTube channel on Photoshop tutorials² has more than 170 thousand subscribers.

Video tutorial sharing sites generally contain comment sections that allow users to provide feedback about tutorials and read the comments that have already been posted. Users can utilize comment sections to express various opinions about video tutorials, such as pointing out a problem or providing some alternative methods for the same workflow mentioned in the tutorial. Moreover, users can get

¹<https://www.youtube.com/watch?v=bNB9Mepi1VI>

²<https://www.youtube.com/user/terrywhitetechblog>

additional information by reading comments posted by other users. For instance, a comment might contain website links providing additional assistance along with the video tutorial.

Comments in video tutorials are traditionally displayed in separate threads below the video. This separation of the video and comments creates cognitive load for users when they try to relate comments with the content of tutorials [37]. Also, this separate section makes comment navigation tedious. As existing systems do not offer an option of viewing comments directly relevant to a specific segment of the video, users might miss a comment that could have been useful to them.

In this thesis, we investigated how people are using the comment section of video tutorials. Following this, we explored alternative designs of integrating comments in video tutorials and its impact on users' performance. Specifically, our research questions were the following:

- How people are using comment sections of video tutorials?
- What are some alternative ways to integrate comments in video tutorials?
- What impacts do different integration techniques have on users' performance while finding particular information from comments?

To answer these questions, we initially conducted a qualitative analysis on the comments posted on popular YouTube video tutorials, in order to understand how people are using comment sections. Our qualitative analysis indicates that users post different types of comments in video tutorials, and often these comments point directly to specific time and content within the tutorial.

After exploring different existing designs for integrating comments in video tutorials, we developed a system called ‘VidComm’. This system allows users and authors to personalize comments according to their information needs. Using this system users can visually integrate tutorial contents with corresponding comments, which clarifies their understanding and provides an easier navigation option.

To evaluate the VidComm interface, we conducted a controlled laboratory experiment with 18 participants, where we explored the impact of the VidComm interface on users’ performance while finding information from comment sections. In the experiment, the participants were asked to find particular information from comments using three different interfaces including VidComm. The result of evaluation suggested that the VidComm interface helped the participants find comments more quickly and more accurately than a traditional commenting system. Moreover, participants subjectively preferred VidComm compared to the other two interfaces.

The structure of the remainder of the thesis is as follows. In chapter 2, we review related work. In chapter 3, we report our qualitative analysis of comments on video tutorials. In chapter 4, we describe the design goals, functionalities and implementation details of the ‘VidComm’ interface. In chapter 5, we report the user study that we conducted to evaluate the ‘VidComm’ interface. In chapter 6, we conclude this thesis by summarizing our contributions, discussing the limitations and suggesting possible future directions.

Chapter 2

Related Work

In this chapter, we explore relevant research from four areas. We begin our discussion with research that has looked into the enhancement of tutorial interfaces. Following, we briefly describe work that has focused on utilizing different types of community feedback. We then review literature that has analyzed comments for different purposes. Finally, we explore existing work related to the categorization of community feedback.

2.1 Enhancement of Tutorial Interfaces

There has been a number of projects that have focused on enhancing tutorial interfaces. We have divided this research into three areas: automatic generation of tutorials, interaction with tutorial components and improving users' learnability of application features.

2.1.1 Automatic Generation of Tutorials

Web-based tutorials have been helping both novice and expert users learn different tasks in applications [40]. However, the authoring of these tutorials can be difficult. So, in order to make the process of authoring tutorials more effective, prior research has focused on the automatic generation of tutorials. Grabler et al. [18] designed a system that allows users to generate text- and image-based tutorials automatically while demonstrating tasks in the application. This system uses an image processing technique to capture users' interactions with the software to generate tutorials. Researchers have also focused on the automatic generation of video tutorials. For example, MixT [9] is a system that enables users to generate short video tutorials while they are demonstrating different tasks in the application. This is done based on the logs of commands and input events that are generated when users are performing different tasks in the application. In this thesis, instead of automatic generation of tutorials, we focused on helping authors using the comments posted to video tutorials.

2.1.2 Interaction with Tutorial Components

Researchers have developed tutorial systems where users can directly interact with different components of the tutorials. For example, Chronicle [20] is a tutorial system that allows users to record the entire workflow history of a tutorial. In this system, users can also interact with specific areas of the workflow history. In addition, Nguyen and Liu [39] designed an interactive system that enables users to interact with different events inside video tutorials as if they are performing the

tutorial task in the application. While designing VidComm, our main focus was to augment video tutorial interfaces through an improved interaction with users' comments.

2.1.3 Improving Learnability of Application Features

There has been some work that has looked into the improvement of the learnability of different features of applications. Kelleher and Pausch [23] developed 'Stencils', an interactive tutorial interface that shows tutorial instructions on a semi-transparent overlay over the application interface. While following the tutorial, the users interact with different features of the application through the overlay. The tutorial overlay passes different interaction events (e.g., mouse and keyboard click events) to the main application only if they are correct. This reduces the mistakes made by the users while following tutorials and improves users' learnability of different features of the software. Sketch-Sketch Revolution [14] is another content-centric interactive tutorial system that enables users to experience existing tutorials created by an expert. This system helps users understand how professionals use different features in an application. Grossman and Fitzmaurice [19] developed an in-application help system called ToolClips, which integrates contextual video tutorials in different tools of the application. The purpose of this system is to improve the learnability of different tools of the application.

Researchers have applied the gamification approach to improve the learnability of different features of applications in an engaging way. Dong et al. [13]

developed a discovery-based interactive tutorial system called Jigsaw, which is embedded in Adobe Photoshop. This system helps users learn new features by solving puzzles using Photoshop tools. Based on the Jigsaw system, Li et al. [32] built another game-based interactive tutorial system called GamiCAD, which is integrated with Autodesk's AutoCAD. Using GamiCAD, first-time users learn different features of the application by completing game-based tutorial missions. Also, this system provides real-time feedback to users about their performance, so that they can improve from their successes and failures. Moreover, Li et al. [33] developed a multiplayer interactive tutorial system called CADament, which is also integrated in Autodesk's AutoCAD. In contrast to GamiCAD, CADament provides an engaging learning environment through competition with other users.

In VidComm, users can link comments with tutorial content and view comments that are linked with contents. As most of these linked comments provide information regarding problems and suggestions related to the target application features, VidComm might provide a different way to improve application learnability.

2.2 Utilizing Community Feedback

There has been some research on community feedback available in learning documents (i.e., tutorials and MOOC videos). This community feedback comes in different forms such as comments, crowdsourced help, user-generated videos and in some cases user log data. Moreover, there has been some research on the comments posted in media players.

2.2.1 Crowdsourced Help

Researchers have done some work on crowdsourced help in different ways. One type of work has looked into integrating crowdsourced help with the application. One example is Matejka et al.'s IP-QAT [36] that helps users by integrating relevant posts from community forums in the software. This system is context-aware and the posts are shown based on the recent activity of the users in the application. Furthermore, LemonAid [10] is a system where questions and answers posted by users are integrated with different user interface elements of websites.

Prior work has also looked into improving video tutorials using crowdsourcing techniques. For example, Kim et al. developed an interactive video player called 'Toolscape' [24] that enables users to view descriptions and thumbnail results of different steps of video tutorials. This approach uses crowd workers to annotate and verify the steps of video tutorials [26].

2.2.2 User Generated Videos

Previously, in some work, researchers have used user-generated videos as a form of community feedback to augment video tutorials. For example, Lafreniere et al. [28] developed a system called 'Follow-Us' that integrates an application into web-based video tutorials. While following video tutorials in this system, the users can demonstrate tasks using the integrated application. 'Follow-Us' captures additional user demonstrations as video tutorials and makes those available to other users to follow.

2.2.3 Utilizing User Log Data

To enhance the experience with MOOC videos, researchers have used user log data, which can be considered as an implicit form of community feedback. Kim et al. [25] designed a video interface called ‘LectureScape’ that utilizes user log data of MOOC videos shared in popular video hosting sites to improve the navigation experience with educational videos. This system contains different widgets to improve learner’s experience. For example, in this system users can visually highlight the video frames that have been watched by other users frequently.

2.2.4 Comments

One of the most common forms of community feedback is comments posted by users in online media players and learning documents (i.e., tutorials and MOOC videos). We have divided the research related to comments into two categories. One type of work has focused on the comments found in media players. Another type of work has looked into the comments posted in learning documents.

Comments Posted in Media Players

There are some existing media players and research prototypes that have augmented traditional threaded comment systems of online media players. Existing systems like SoundCloud [3], Viki [4] and Niconico [2] enable users to post and view comments at particular times of web-based media players. Moreover, there are some research prototype systems [22, 30, 29, 38, 7, 5, 43] that have enhanced traditional threaded commenting systems of video sharing sites by allowing users

to post comments in the timeline of the video. Although the VidComm interface shares some similar features with these systems, these interfaces do not enable users to filter comments from different categories, which is available in VidComm.

Comments Posted in MOOC Videos

Prior work has focused on the enhancement of comment sections of learning documents such as MOOC videos. In the current design of MOOC videos, the three important components (i.e., video, comment threads, and assessment questions related to the MOOC video) are displayed separately by either page layouts or page separations, which makes it difficult for users to find relevant comments related to a particular assessment question [37]. Addressing this limitation, Monserrat et al. [37] proposed an alternative design and implemented a system called L.Ive that visually integrates the comment section and assessment questions with the video. In this system, users can interact with the comments by hovering over comment tags inside the video. Users can also interact with the anchors in the timeline of the video. After clicking a comment tag or an anchor, the comment is displayed on the side of the video. The advantage of this system is that users do not have to look into a separate comment thread while watching the video, which allows them to understand and learn more information. VidComm and L.Ive share similar features such as: integration of comments in the timeline and linking comments with the content. However, there are two differences between VidComm and L.Ive. First, VidComm allows users to filter comments from different categories. Second, in the evaluation, Monserrat et al. focused on

the knowledge gained by the participants whereas the goal of our evaluation was to understand the impact of different integrations on finding particular information from comments.

In another work, Lee et al. [31] developed an interface for MOOC videos where the users can post and view time-anchored comments while watching the video. The evaluation of this system suggests that the time-anchored comments enhance users perceived social interactivity. Our system ‘VidComm’ shares some similar features with this system. However, our approach allows users to filter comments from different categories. Moreover, in our evaluation, we were interested to know how much VidComm helps users to find particular information from comments, whereas in the previous work they explored the perceived engagement, perceived social interactivity (e.g., discussing new ideas) and learning outcomes while following comments in their system.

Some MOOC sharing websites have explored alternative ways to represent comments. For example, Khan Academy [1] allows users to filter comments from different categories. However, these comments are not integrated in the timeline of videos and there has not been any formal evaluation of this system.

2.3 Analysis of Comments

In previous work, researchers have analyzed user comments found in different websites. Some work has looked into the comments posted in content sharing sites (e.g., YouTube, Yahoo! News etc.) to explore the commenting behavior of users. For example, Siersdorfer et al. [41, 42] conducted studies on comments found in

YouTube and Yahoo! News in order to analyze the relationship between different metrics of videos such as comments, view-counts, comment ratings, etc.

So, we see that researchers have analyzed comments using different algorithms to understand many different aspects, including commenting behaviour of users and relationship between viewing metrics of video. In this thesis, we have qualitatively analyzed comments to understand the usage of comment sections of video tutorials.

In terms of analyzing the comments posted in tutorials, there has been little prior work. The only exception is Lafreniere et al.'s [27] analysis of comments posted in text- and image-based tutorials. Their qualitative analysis of the comment section found different usages of text- and image-based tutorials. For example, they reported that people mostly use these tutorials for immediate help while performing a particular task in an application. They described the types of comments people generally post in these tutorials. For instance, they reported that users post 'help-me' comments, which contain a list of steps that they had performed in the application before getting an unexpected or erroneous outcome. They found that readers frequently post comments that mention problematic sections of the tutorial. In this thesis, we replicated the method used by Lafreniere et al. [27] to qualitatively analyze the comments of video tutorials, to understand how people are using the comment section of video tutorials and to inform the design of our system.

2.4 Categorizing Community Feedback

In prior work, researchers have designed systems that help users to categorize community feedback. This work has helped us to design the categorization of comments feature of VidComm. Willett et al. [45] designed a visual analytic system called CommentSpace that allows users to categorize comments. An evaluation of CommentSpace indicated that this system helped participants to categorize comments more accurately compared to an uncategorized comment system. In order to support citizen scientists, Luther et al. [34] designed an online community system called Pathfinder where the users can track scientific data and annotate comments. An evaluation of Pathfinder suggested that the organization of this system motivated users to participate in this kind of scientific online community.

There has been little work on categorizing the comments of tutorials. The only exception is ‘TaggedComments’ [6] that allows users to tag (categorize) comments of text- and image-based tutorials according to their personal information needs. The tagging of comments provides a summary of community feedback, which is helpful for both authors and users of tutorials. Also, this approach assists users by allowing direct access to comments that users might find useful. Although our system and TaggedComments share some similar features (e.g., categorization of comments), TaggedComments focused on comments of text- and image-based tutorials whereas we focused on comments posted in video tutorials.

2.5 Summary

Previously, researchers have developed different systems that augmented existing tutorial interfaces [18, 9, 20, 39, 23, 14, 19, 13, 32, 33]. Moreover, there have been a number of projects that utilized community feedback [36, 10, 26, 28, 25, 22, 30, 29, 38, 7, 37, 31, 27] to augment media players and learning documents. Further, we have found some research that have looked into categorization of comments [45, 34, 6]. However, prior work has not specifically looked into the integration of comments in video tutorials, which is our research objective.

Chapter 3

Qualitative Analysis

Initially, we conducted a qualitative analysis on the comments posted in YouTube video tutorials. The purpose of the analysis was to understand how people are using the comment section of video tutorials. This investigation also allowed us to gain insights on the design guidelines to enhance the comment section of video tutorials. Moreover, the results of this analysis enabled us to compare our findings with that of previous work by Lafreniere et al. [27] where they analyzed the comments posted in text- and image-based tutorials. The purpose of this comparison was to see whether their results would generalize to both text- and image-based tutorials and video tutorials.

3.1 Methodology

To perform a qualitative analysis on comments of video tutorials, it is necessary to get a diverse and representative sample of comments. To get this sample of

comments, we chose YouTube as our source, as its collection of video tutorial is large and varied. In order to get a representative set of popular YouTube video tutorials, we employed the CUTS (Characterizing Usability Through Search) method developed by Fournery et al [16]. CUTS method was developed to label, filter and approximate popular search queries gathered from publicly available raw queries of different applications harvested from search engines. An example of this method is as follows: when a user types '<Application Name> how to' in the Google search bar, the search engine would suggest a list of queries (see Figure 3.1). These are the popular queries searched by other users. According to the CUTS method if a search query is phrased with '<Application Name> how to' then the search engine will show a list of web-pages that are most likely tutorials related to that particular application. This technique was also used by Lafreniere et al. [27] to study the comments posted in text- and image-based tutorials. In the original work by Fournery et al. [16] the CUTS method was applied in the Google search engine, but for this work we implemented this method in the YouTube search engine. Here is an example of how we got popular search queries from YouTube using the CUTS method: when a user types 'Photoshop How to' in the YouTube search bar, it suggests a list of popular search queries (e.g., Figure 3.2). As we have mentioned earlier, according to the CUTS method, the query phrased with '<Application Name> how to' (e.g., 'Photoshop how to make a logo') will result video tutorials for that particular application. We applied the CUTS method in the YouTube search engine for three popular applications: Microsoft Word, Excel and Adobe Photoshop. After executing the CUTS method we got a list of queries and

selected the top three queries for each application. We filtered out broad queries like ‘how to use photoshop’. The final list of queries are shown below.

how to put two pictures together in photoshop

how to make a logo in photoshop

how to blend image with background in photoshop

how to make a brochure in microsoft word

how to number pages in microsoft word

how to make a chart in microsoft word

how to make a table in microsoft excel

how to make a line graph in microsoft excel

how to calculate in microsoft excel

In the next step, we executed each query mentioned above and inspected the videos that the YouTube search returned. We examined the first two pages of the search results and saved the first four videos. This process yielded a total of 36 videos (Adobe Photoshop 12, Word 12 and Excel 12). These videos had a total of 10482 comments as of 9 June, 2014 (Photoshop 5282, Word 2670, Excel 2530). From each video we analyzed the first 50 comments (maximum) which were published earlier in the chronology because we found that generally people posted more interesting comments at the beginning. This yielded a total of 1406 comments (Photoshop 553, Word 333 and Excel 520).

We analyzed the comments using systematic coding [44]. We used the codes from Lafreniere et al.’s [27] work as our base codes. However, we found that many



Figure 3.1: Google auto suggestion technique

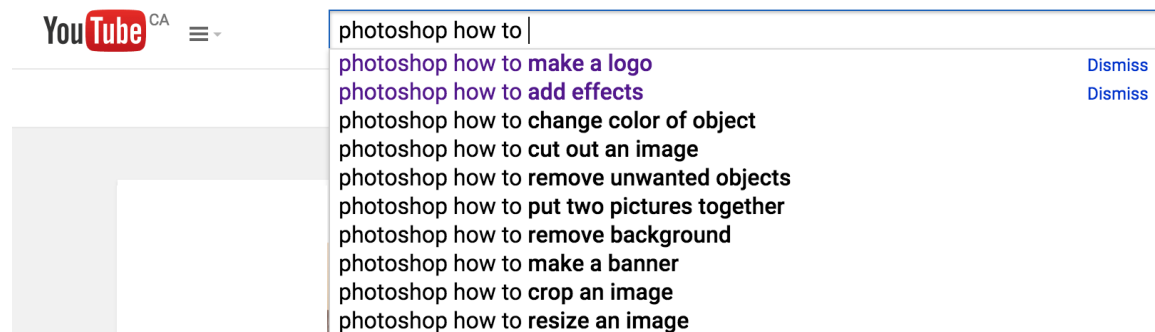


Figure 3.2: YouTube auto suggestion technique

comments in the sample did not fit into the base codes. So, in addition to the base codes, we added new codes using an open coding method [12]. It is to be noted here that one comment might have more than one code. Our coding scheme with

examples is provided in Table A.1 of the appendix.

3.2 Comparison with Lafreniere et al.'s Analysis

The previous work by Lafreniere et al. [27] analyzed the comments of text and image-based tutorials. We compared the results of our coding (percentage of comments for each code) with the results of the previous study's coding. The comparison indicates that in most cases there were substantial differences between these two results (see Table A.2).

Our analysis found that 'thanking the author' and 'praise and encouragement' had the highest percentages, which is consistent with the findings of the previous work. Although the 'praise and encouragement' code in both analyses had equal percentage (42%), for the code 'thanking the author' the result was substantially different. In our sample, we had higher percentage of comments where people were expressing gratitude towards the authors (45% compared to 28% reported by Lafreniere et al. [27]). In addition, in our sample, we found a lower percentage of comments where the users or authors were responding to comments (3.22% compared to 17% reported by Lafreniere et al. [27]).

In our analysis, we found comments that mentioned problems or failure while following the tutorials to be 3.13%, whereas in previous work the percentage was 10%. In both samples, there were comments asking for clarification for some part of the tutorial. Again, the percentage of comments for this code was lower in our analysis (3.06%) compared to that of previous work (10%).

Moreover, in our coding, we found only 0.43% comments where the users

discussed the application whereas the previous work found the 16% comments in the same category. Also, our analysis showed that only 0.36% comments discussed the final outcome of the tutorial, compared to that in previous research where the same percentage was (6%).

So, there were substantial differences in the relative percentages of our coding and the coding performed in the previous work [27]. One possible explanation for this difference could be that our coding scheme was more diverse than their coding scheme and because of this we had low percentage of comments for some codes (except the code ‘thanking the author’ and ‘praise and encouragement’). For example: we had the following codes ‘mentioning a problem or failing while following the tutorial’ and ‘questions related to the tutorial’ while in the previous work they only reported the ‘mentioning a problem or failing’ code. Presumably, it could have happened that in the previous work they only used one code to represent a set of comment whereas we might have split that single code into multiple mutually exclusive codes. This could have reduced the percentage of comments in each category. Another explanation could be that people post more diverse comments in video tutorials compared to text and image-based tutorials.

3.3 Tutorial Uses

In this section, we look into the motivation for using video tutorials by analyzing the comments. While analyzing the comments we looked for the similar usages reported by Lafreniere et al [27]. and found three similar themed usages. These are: in-task help, improving one’s skill-sets and the practice of expert

shadowing. Apart from these three, we found one additional different usage of the video tutorials.

3.3.1 In-Task Help

One of the most common type of comments indicates that video tutorials provide in-task help which is assisting the users in unfamiliar tasks. The following comment from a Microsoft Word tutorial is an example this type of usage:

Thank you a lot! I was trying to do this for the last hour!!!! The help in word for this is not so good...

The above comment suggests that the user did not get proper assistance from the native help system of the application. The video tutorial helped the user to complete the task immediately. The following comments also suggest the urgent need of the tutorial contents:

Thanks a lot. It was very helpful. I found it when I badly needed it. Thanks again.

This took way too long searching on Google. Thank you so much for posting this video. What a help!

This usage of video tutorials can be explained as an alternative of in-application help systems. Similar usage was also reported by et al. [27] in their text- and image-based tutorials' comment analysis.

3.3.2 Improving One's Skill-Sets

Some viewers also use the video tutorials to improve their skills. These users do not have the same urgency and also do not require immediate help from tutorials like the 'in-task help' usage described in the previous section. However, they watch these videos in order to improve their skill for a particular software which could be useful in the future. For example:

thanks so much for this tutorial, your vids have helped me a lot to improve in photoshop specially because im a photography student and ive had a lot of trouble with photoshop but your tutorials have made my life easier thanks again! [sic]

Wonderful. I fully understood the concept and the words "Pivot Table" always intimidated me before. I am going to take some excel testing today and I know this will be useful! Thanks! [sic]

The above comments suggest that the viewers did not seek solutions to some specific problems and also did not use tutorial contents instantly. Similar usage was also reported by Lafreniere et al [27]. So, from our observation we can speculate that both forms of tutorials are helping users to improve their skill-sets.

3.3.3 Expert Shadowing

Lafreniere et al.'s [27] analysis of the comments of text- and image-based tutorials described a usage of expert shadowing. In this type of use, the users follow the tutorial and achieve an end results beyond their current skills. In

our investigation we also found comments which indicated the use of expert shadowing. For example:

WOW, I just did a flier in one setting following your video. At first I was intimidated by the process, NOW I am better and experienced flyer maker. They loved my work! I was kind of impressed myself. Thanks so much for sharing and making it look easy.

In this comment, the user expressed enthusiasm with a sense of accomplishment. Also the comment indicates that the user is showing pride over the final output (“*I was kind of impressed myself*”). This enthusiasm combined with some initial difficulty (“*At first I was intimidated by the process*”) faced by the user, suggests that the video tutorial helped the user to achieve a result beyond his/her current skill level.

3.3.4 Promoting Personal Product

Our analysis of the comments revealed one different usage of video tutorials from the authors’ perspective. We found a few comments which indicated that creating tutorial videos might help the authors to promote their personal products such as CD and DVDs of the tutorial. For example:

Let’s face it how many commercials do you see when watching TV? This is the only way to advertise my DVD’s and it helps to keep the shows going. Thanks for the comment.

We checked the video and found out that the author mentioned the DVD at the beginning of the tutorial. Here, the video tutorial plays the role of showing demo to the users so that they might be impressed and buy the DVD. So, a good video tutorial might work as a good advertisement for personal product or service.

3.3.5 Discussion - Tutorial Uses

From our analysis, we found three common usage of video tutorials: in-task help, ongoing skill refinement and expert shadowing which were also reported by Lafreniere et al [27]. We think that these three usages can be generalized to both video tutorials and text- and image-based tutorials. Moreover, another usage suggests that the authors are using the tutorial to promote their personal product or website.

Our analysis suggests that in-task help is one of the common usages of video tutorials. Users follow these tutorials in order to solve or complete tasks in applications immediately. The comments indicate that the native help system of the applications do not provide proper assistance to complete different tasks, so the users follow these tutorials to get help. We think there could be future research on how the native help system of applications can be improved farther so that it could support users immediately while they are performing a task. One example of such research is Ambient Help, an in-application help system, which is developed by Matejka et al. [35]. This system helps users by automatically showing relevant video tutorials in a secondary display, while users are performing tasks in the main application in the primary display.

We found another usage where users are watching tutorials in order to improve their skill-sets. We think that this set of users are enthusiasts or professionals who want to keep themselves updated with different tasks and features that can be done with the application. As these users are looking forward to learn new techniques, future research could be done to recommend these enthusiastic users some tutorials that have done similar tasks in different approaches, which could improve their repertoire of skills.

3.4 Use of Comment Sections

In a previous work, Lafreniere et al. [27] reported different uses of comment sections while analyzing the comments of text- and image-based tutorials. In this section, we look into comments of the video tutorials to see whether the comments of similar themes could be found.

3.4.1 Communication between the Viewers and Authors

Lafreniere et al.'s [27] analysis found that the most common use of the comment section was to provide praise, encouragement or thank the author. In our analysis we also found the same. Most of the comments were simple expression of gratitude:

WOOHOOO a simple tutorial! thank you :-)

Also, in some comments the users mentioned about the authorship. For example:

I just spent the weekend editing a series of composite layered images and you showed me two tricks I could have used during that process, I always enjoy seeing vids like this, thanks Mike!!

These comments indicate that the viewers are getting proper assistance from the video tutorials and they appreciate this help. Additionally, the authors are using the comment section to value the positive feedback from the users. The following comment is an example:

I thank everyone who watched this video and commented. I really appreciate your comments, they pay off all the hard work of putting these videos together. Thanks ALL! -PakiHack-

Users are also using the comment section to get the personal contact information (email/skype address) from the authors. For example:

*any chance you can give me your skype need to ask something
my skype is: Aqatix i won't be on for the next 8-9 hours though*

We observed only five comments of this type. Out of the five comments, in three, the authors responded to the users with proper contact information. We suspect that if the users found the tutorials useful then they might contact the author using the comment section in order to get assistance for specific tasks.

3.4.2 Showing Personal Skill-Set

Lafreniere et al. [27] mentioned a usage of comment sections where the users are seeking validation of alternate 'best' techniques through comments. An

example comment of this usage [27]:

Wow. I've never used any of those methods (though I have gotten compliments on how cleanly the image was cut regardless). Man, alive, do I feel stupid. I guess I'll have to try these methods out sometime. Out of curiosity just how dumb is it to cut out using paths? (Or whatever the photoshop equivalent is...I'm a GIMP'er myself)

In our analysis, we found a related, but slightly different usage of video tutorial's comment sections where the users are showing some demonstrations of personal skill-sets by providing some alternate methods but not necessarily seeking validation. The viewers consider these alternative approaches as 'better' than the steps mentioned in the tutorial. The following comment was posted to a Photoshop tutorial on how to blend image with background:

I think this could have worked so much better if the woman was merged into the man's photo rather than the other way around....not just because the photo is a little more quirky up stretching his image will diminish the quality. Also just erasing the outer edges of the layer is a little risky, I find it better practice to use a quick mask to make a more detailed selection that can be removed in one motion once perfected.

Here, the user seems to be aware of the techniques used in the tutorial. The user then suggested an alternate way to get a 'better' result. The way the user mentioned that "just erasing the outer edges of the layer is a little risky" gives us a sense that the user had previous experience with Photoshop. To follow up, we

found that this user has a YouTube channel where he/she has uploaded some Photoshop tutorials. So, users with more experience might find the comment section a good place for showcasing their personal skills.

3.4.3 Asking Help for Troubleshooting

Lafreniere et al. [27] also described a use of comment sections where users may execute the steps of the tutorial like running some program scripts. These comments are similar to the stack trace of a debugger. In our sample, we looked for similar themed comments but there were not any examples of that kind. Instead of that, we found some evidence where the comments mentioned problems that required troubleshooting. These comments are different from the previous work's [27] theme because the examples we found in our analysis had reduced description of the problem compared to the comments found in the previous work. For example:

*Hello. When I go to paint the face (after following the steps in the video).
The face begins to be erased, and its the background that can be painted
black. Have I missed a step some where along the line? I enjoy the video it
is easy to follow except I am missing something. Thanks in advance*

The above comment indicates that the user had followed the steps described in the tutorial but the final output was not desirable and the user required assistance to solve that problem. Another example that says the tutorial is not working:

it doesn't work with me :(when i try to blend it only get's black and white.

witch settings are wrong in my photoshop? is there any tutorial on how to set the settings? [sic]

We also found comments where viewers mentioned the exact time of the video where they faced the problem. For instance:

What is the option you used at 3:40? I can not find it!!

In the previous work [27], the examples of stack traces were more elaborate. For example:

nothing but problems with this in cs4 :s 1st issue was the adding levels and hue/saturation which neither worked because it kept saying selected layer is empty.. so i skipped that and moved onto the line following exactly whats wrote, made the lines saved them as dmap.psd, unhide other layers and delted lines select- ed text layer filter>distort>displace> pressed ok selected the dmap.psd and then all that happend was the text moved up and to the left a slight bit :s

These types of comments provide information about the problems faced by the users while following the tutorials, if the tutorial authors document these problems properly then it could be useful for the authors to improve the tutorial instructions in future versions.

3.4.4 Community Refinement of the Tutorial Content

In the previous work, Lafreniere et al. [27] reported a use of comment section where the users are performing the quality assurance role. These comments

indicate that the users are testing the steps of the tutorial and letting other users know whether the technique described in the tutorials works or not. In our analysis, we found some comments that fit into similar theme. For example, here is a comment where a user applied a Photoshop tutorial method in different applications:

I attempted to do it in Pixlr, because they are basically the same in my point of view, then it screw me over.. So I went to GIMP and THAT lagged like hell so I went on Paint.Net and did it. And it actually turned out pretty good! If you don't mind could you look at my new Logo, anyone? :) [sic]

The above comment indicates that the viewer successfully applied the same technique for Paint.Net but failed in Pixlr and GIMP. This type of comment might encourage other users who do not have Photoshop but have other applications to test the same technique described in the tutorial.

Moreover, the users are contributing to the improvement of the video tutorials by providing important information in the comment section. They are also providing advice and suggestions to solve problems. Here is an example:

I found out (by accident) that if the top one (the one with no fill) is a little higher than the bottom one (but not too much), it get a really cool 3D effect on top of the effects already present.

In the above comment, the user provided some suggestions to get a better result. These comments from users are performing the role of community refinement to the video tutorial contents.

3.4.5 Opportunistic Support Forums

Lafreniere et al. [27] also pointed out another use of comment section, that is called ‘opportunistic support forums’. In this type of usage, the users looked for assistance for problems that are distinct from the original tutorial content. In our sample, we also looked for examples which might fall into that theme. The following example is taken from a Microsoft Excel tutorial on how to make a table:

Very cool. Your static table headers vs. freezing panes tip was a home run. I was a SQL hacker in the 90's, comfortable with tables and key fields so this refresher was perfect. I need to build upon a sheet I use to enter real estate property info I need in deciding whether or not to buy, also to sell. As an investor, I have my own formulae I use to filter my prospects. Can you help? Maybe we could collaborate your tutorial of solving my problem once in a while? Thanks!

The above comment states that the user was looking for some solution for a problem which is out of the scope of this tutorial. Still the user asked because he/she thought that the author might be able help or collaborate to solve the problem. We also found another example:

Hi man I hope you could reply to me today .. I have my final assessment tomorrow and the interviewer told me that pivot table would be ask .. can you tell me what would be the usual questions I will encounter and the answer for it thx!

Clearly the question asked in the above comment has no relation with the application or the tutorial. Here, the user is looking for some suggestions for his/her upcoming interview which could be described as an opportunistic behaviour.

3.4.6 Discussion - Use of Comment Sections

Previously, Lafreniere et al. [27] analyzed comment sections of text- and image-based tutorials and reported different usages of the comments. In our analysis, we found evidence of similarly themed usages. Comment sections provide a way of communication between viewers and authors. We found comments where the users were praising and thanking the author for the tutorial. Additionally, the viewers use comment sections of video tutorials to provide information about problems they have faced while following tutorials. Some of these comments also mentioned the exact time of the video where they faced the problem. Through comments, viewers discuss the parts of video tutorials that did not work properly and the parts of tutorials they found useful.

Overall, we found that people post various types of comments in video tutorials' comment sections. Also, in some comments, users indicated exact times of videos where they faced some problem. Additionally, we found comments that pointed to particular contents of video tutorials. These findings helped us set the design goals for an augmented commenting system called 'VidComm', which we describe in the next chapter.

3.5 Summary

In this chapter, we analyzed the comments of YouTube video tutorials in order to understand how people are using video tutorials and comment section of video tutorials. From the analysis we found similar usages of tutorials and comment sections that was reported by Lafreniere et al. [27] in their qualitative analysis of text- and image-based tutorials. Finally, our analysis on the use of comment sections provided some design concepts on developing an enhanced commenting system for video tutorials, which we describe in Chapter 4.

Chapter 4

System Description

In this chapter, we present ‘VidComm’, the prototype system that we have implemented and describe its different functionalities. The main aim of the VidComm system is to enhance users’ experience with the comments of video tutorials by allowing users to find comments according to their information needs.

4.1 Design Goals

While designing the system, our goals were as follows:

4.1.1 Enhancing Comment Navigation

Consider this scenario: Mary is following a YouTube tutorial on making a logo in Photoshop. The tutorial comments are organized below the video. While Mary is performing the task in Photoshop, she faces some problem with a command. The command is described in the second minute of the tutorial. If Mary needs

to find some solution from the comment section instead of searching the internet, she has to browse through all the comments in order to find those comments that are relevant to her problem. Moreover, the comments have to be related to the particular time of the video, as the same command has been used in different parts of the tutorial. In this situation, scrolling through all the comments would make the comment navigation tedious and time consuming. Therefore, one goal of designing VidComm was to enhance existing comment navigation systems of video tutorials by integrating comments in video tutorials.

4.1.2 Allowing Users to Filter Comments

From our qualitative analysis, we have found that people post various types of comments in video tutorials. These comments include asking for help, providing solution, appreciating the authors and more. Users cannot filter comments according to their information needs in existing video tutorial comment systems. Even if users want to view only the comments that are related to suggestions, they have to scroll the entire comment section and read each of the comments. This is true for the authors as well. For example, if the authors want to reply to comments that mention a problem, they do not have a way of filtering only those particular comments. Hence, one of our goals was to enable both the authors and the users of the tutorials to filter from different categories of comments according to their information needs.

4.1.3 Highlighting Contents of Video using Comments

Our qualitative study also showed that some comments point directly to the contents of the tutorials (i.e., aspects within the video itself). However, the comments are not visually linked with the corresponding video contents in existing systems. If users could highlight the contents of the tutorials to which they are referring in the comments, it would be beneficial for both other users and the authors. They would be able to understand the comments more precisely.

4.2 System Functionalities

Here, we describe the different functionalities of VidComm. Different components of the interface are labeled in Figure 4.1.

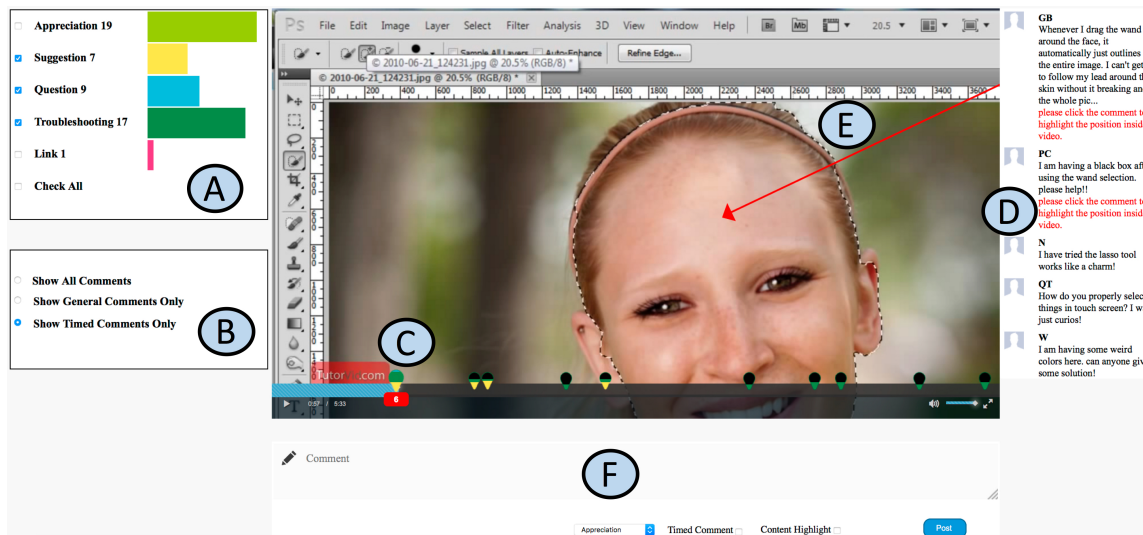


Figure 4.1: Different components of VidComm: (A) categories available for filtering comments, (B) available options for selecting timed comments, (C) anchors inside the seekbar of the video, (D) comment section, (E) highlighted content of the video, (F) text field for posting comment

4.2.1 Posting Comments

While posting a comment using VidComm, first the users have to select a category (e.g., appreciation, suggestion etc.) from a dropdown list (see Figure 4.2(B)). Users can additionally click a checkbox to make the comment timed (see Figure 4.2(B)). After checking the timed comment option a marker will appear on the seekbar of the video (see Figure 4.2(C)). Users can move the marker within the seekbar to set the time. To highlight specific contents inside the video, the users have to click another checkbox (see Figure 4.2(B)). Then a red pin would appear inside the video (see Figure 4.2(D)), which can be dragged inside the video to highlight particular parts.

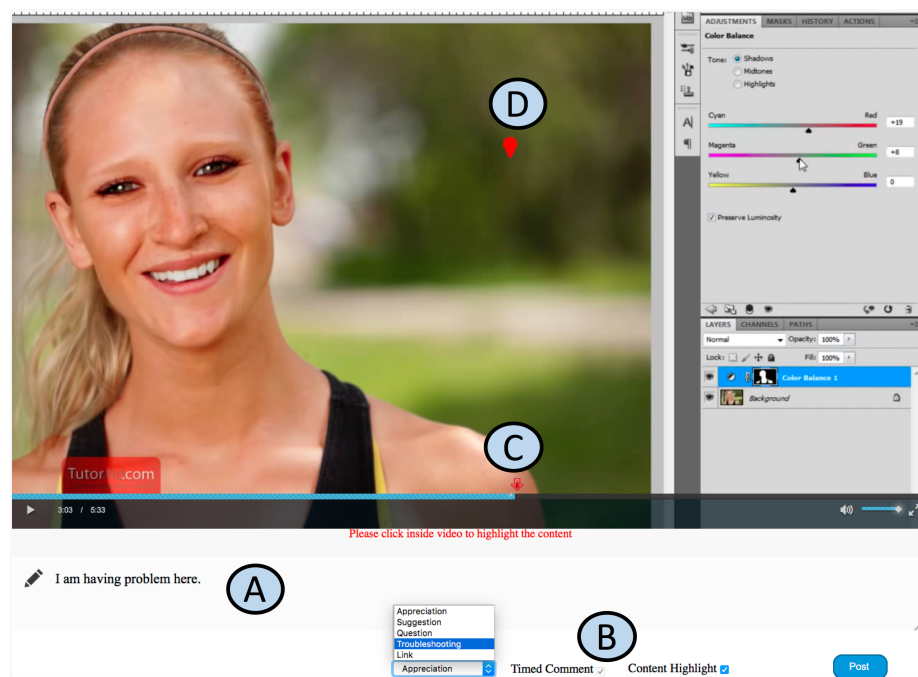


Figure 4.2: Comment posting technique: (A) text field to post comments, (B) options for categories, timed comments and highlighting content, (C) anchor for timed comment, (D) pin for highlighting contents

4.2.2 Categorization of Comments

VidComm enhances the existing video tutorial comment section by integrating different categories of comments in the video tutorial. As shown in Figure 4.3, the comments are organized into 5 different categories. These categories are based on our qualitative analysis of the comments posted in the video tutorials of YouTube:

- **Appreciation:** praise or encouragement for the tutorial author or the technique used in the tutorial
- **Suggestion:** suggestion to improve the tutorial or complete the tutorial
- **Question:** questions related to the tutorial and their answers
- **Troubleshooting:** mentioning problems while following the tutorials and their solutions
- **Link:** a link to another video or website that might be related to the tutorial

Each category has a different color. Also, the number of comments in each category is represented in a color-coded bar graph. Users can filter from different categories of comments by selecting the checkboxes (see Figure 4.3). Moreover, each comment has a different color when comments are displayed at the right side of the video, enabling users to know which comment falls into which category (see Figure 4.4).

The main reason for choosing fixed pre-defined categories as opposed to free-form categories is that previous studies suggest that there are some advantages of having pre-defined categories or tags [8, 17]. For example, the words ‘Problems’

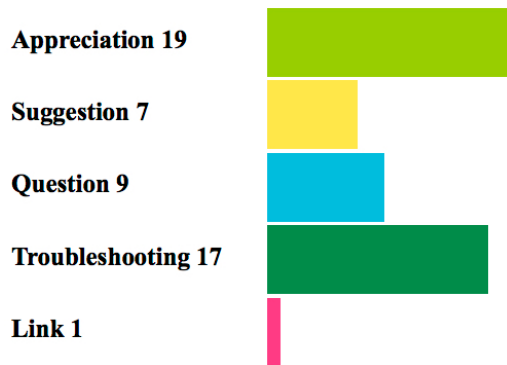


Figure 4.3: List of categories of comments with color code

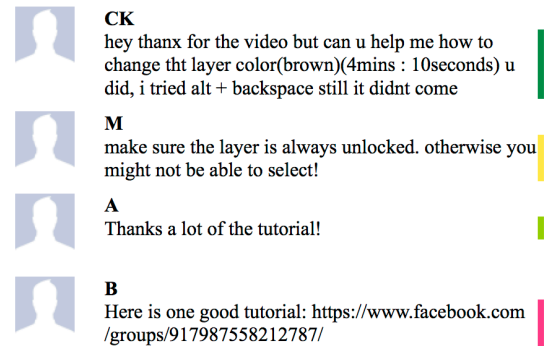


Figure 4.4: Color with each comment

and ‘Troubleshooting’ share similar meaning. If free-form categories were used then one user could have used ‘Problems’ and another user could have used ‘Troubleshooting’ as category names. Having pre-defined categories ensures consistency among the category names.

4.2.3 Integrating Comments in the Timeline

From our qualitative study, we have found that the users post comments that point to particular times of the videos. However, the time information of the comments are not integrated in the existing video tutorial comment system. So, when the readers try to link the comments with the exact time of the video, it creates cognitive load [37]. We have integrated anchors in the seekbar of the video so that users can view the comments just in-place in the seekbar. We had the following design challenges in order to integrate comments in the seekbar of the video:

- Visually representing the number of comments using the anchors

- Integrating different categories of comments in the anchors

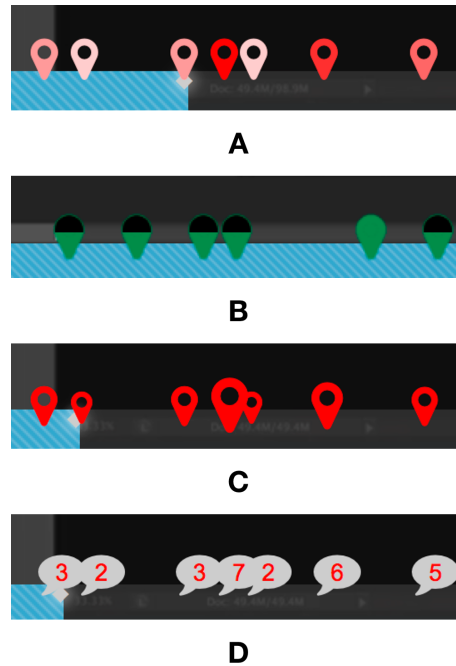


Figure 4.5: Different design for representing number of comments in the anchors: (A) Gradients of color, (B) Filling up the anchors, (C) Varying the size of the anchors, (D) Putting the number of comments inside the anchor

In order to represent the number of comments in the seekbar there could be different designs. One design might make comparing the numbers easier whereas another design might be aesthetically more appealing. In order to explore these two issues we had four designs:

- **Different Gradients of Color:** This design has different gradients of color to represent the number of comments at a particular time (see Figure 4.5(A)). An anchor of a darker color means that it has more comments than that of a lighter color.

- **Filled-up Anchors:** In the second design, we filled up the anchors to represent the volume of comments at a particular time (see Figure 4.5(B)). A fuller anchor indicates that it has more comments than the anchor which is less filled.
- **Different Size of Anchors:** This design has varying sizes of anchors (see Figure 4.5(C)). A larger anchor means that it has more comments than a smaller one.
- **Numbers inside Anchor:** In the fourth design, the number of comments was put inside the anchor (see Figure 4.5(D)).

To select a design, we informally asked nine participants to choose which design they liked most out of the four options, and why. Based on this informal interview we chose the filled-up anchor design (see Figure 4.5(B)) because six out of the nine participants preferred this design. According to their feedback, they chose this design as this approach made the visual comparison between different anchors easier. For example:

Filling the color looks visually effective. Clearly gives the idea that it has more or less comment. Showing the numbers inside text means you have to check each number. Varying color and size is difficult grasp at at a glance. -

P3

Our second design issue was how to represent the number of different categories of comments inside the anchor. We did not explore for any additional design to solve this problem due to time constraints. Instead we enhanced the filled-up



Figure 4.6: Final anchor design

anchor design to solve this issue. We filled up each anchor with different colors to represent the different categories. The portion of each color inside the anchor is proportional to the number of comments each category has at that time of the video (see Figure 4.6).

To view the anchors for the timed comments, the users have to click the ‘Timed Comments’ selection (see Figure 4.7(B)). Then all the anchors will appear in the seekbar (see Figure 4.7(C)). Hovering over an anchor will show the number of comments (see Figure 4.7(C)) and clicking an anchor will show all the comments related to that time on the right side of the video (see Figure 4.7(D)). Also, users can view different categories of comments by clicking the checkboxes (see Figure 4.7(A)). For example, in Figure 4.7 the user has chosen to view the timed comments with the categories ‘Suggestion’ and ‘Troubleshooting’ at 1 minute 33 second.

From our qualitative analysis, we also found that some comments do not necessarily point to a particular time of the video. For example, comments that say ‘Thank You’ or request a download link of the software normally do not point to a time. In VidComm, these comments are organized as ‘General Comments’. Users can view the general comments by clicking the ‘General Comments’ radio button (see Figure 4.8(A)). Then the comments are shown on the right side of the

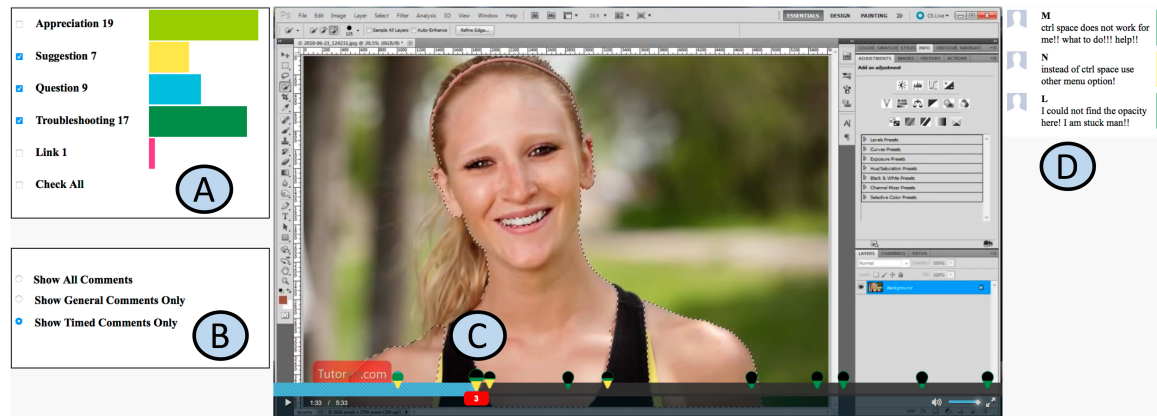


Figure 4.7: Timed comments selection: (A) different combination of categories (B) timed comment option selected (C) anchors clicked to see comments (D) comments in the clicked anchor

video (see Figure 4.8(B)). Users can filter the general comments in the same way as they can filter the ‘Timed Comments’ section.

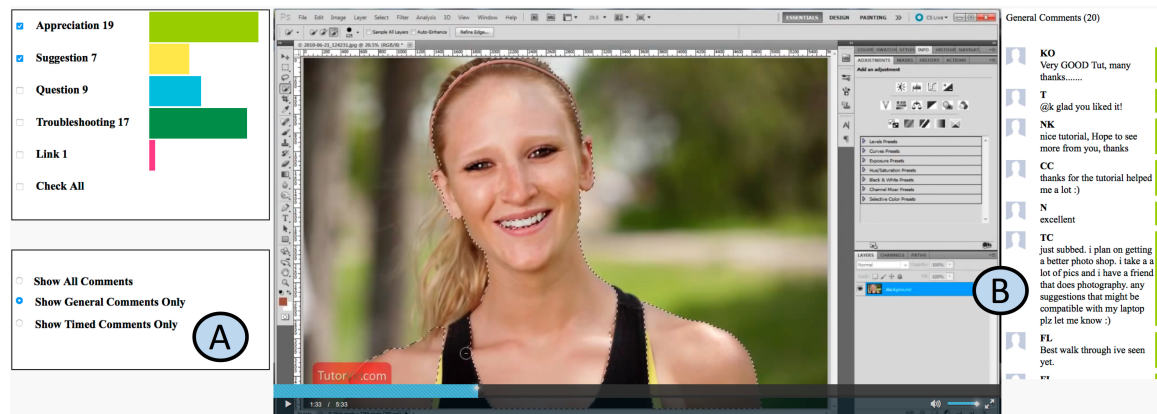


Figure 4.8: General comments selection: (A) general comment option selected, (B) comment section for general comment option

In VidComm, users can view each comment regardless of the time information of the comments by clicking the ‘All Comments’ radio button (see Figure 4.9(A)). The comments will be displayed on the right side of the video (see Figure 4.9(B)).

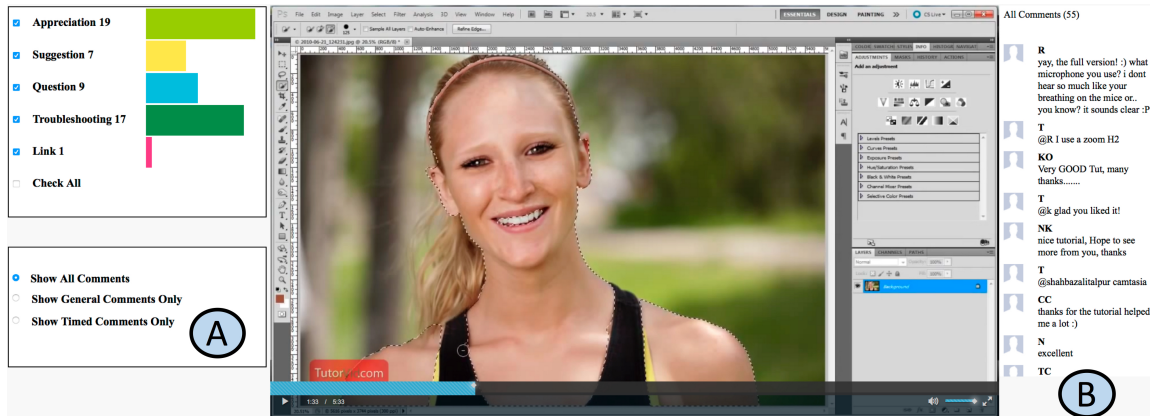


Figure 4.9: All comments selection: (A) all comments option selected, (B) comment section for all comments option

4.2.4 Highlighting the Contents through the Comments

In VidComm, the contents of video tutorials can be highlighted through the comments. If a comment has information to highlight then a message to click the comment is added below the comment (see Figure 4.10(A)). Clicking the comment will point an arrow to the mentioned part of that particular video frame (see Figure 4.10(B)). We also considered other designs, such as introducing different shapes (e.g., circles, rectangles etc.) to highlight the content. However, we found that the authors of the video tutorials use the different shapes to annotate contents inside the video.

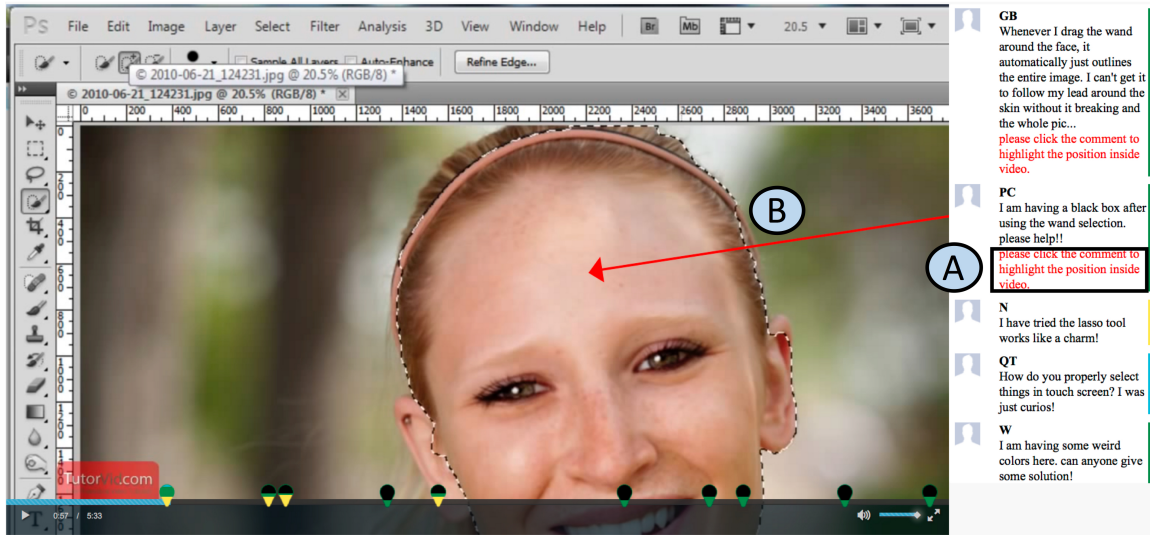


Figure 4.10: Highlighting content: (A) message to click the comment, (B) highlighting the comment

4.3 System Implementation

We implemented ‘VidComm’ in a web browser using a HTML5 video player¹. The anchors inside the seekbar were developed using a marker plugin of ‘Video.js’². The comments were loaded from a JSON file. The content highlighting feature was developed using a javascript library for svg drawing³.

4.4 Summary

In this chapter, we presented the VidComm prototype system. While designing the system, our primary goals were to enhance the navigation of existing commenting systems, and to allow users to personalize comments by filtering

¹<http://videojs.com/>

²<https://github.com/spchuang/videojs-markers>

³<http://svgjs.com>

and highlighting the contents of the tutorial using the comments. Following these design goals, we implemented anchors inside the seekbar to facilitate timed comments allowing users to know which time of the video a particular comment points to. Moreover, VidComm's categorization of comments feature enables users to filter comments according to their personal information needs. Additionally, VidComm allows users to highlight contents within the tutorial using the comments.

Chapter 5

Evaluation

In this chapter, we discuss the evaluation of the VidComm interface. We conducted a formal laboratory study with 18 participants comparing a traditional interface, a timed interface and the VidComm interface. The purpose of the user study was to see whether the timed comment feature and the categorization of comments feature provide any benefit to users navigating comments in order to seek information. For example, we wanted to see whether the timed comments with the categorization of comments enable users to find particular information faster than a traditional comment system. The University of Manitoba's Research Ethics Board approved this user study.

5.1 Participants

We recruited 18 participants (6 females) for the user study by posting advertisement throughout the university campus. The average age of the participants

was 26.1 (S.D=5.7). All of the participants were students. All participants were reawarded with a \$15 honorarium. For extra motivation, the top three performers from the experiment were awarded with an additional \$10. For the given tasks, the top performers were selected based on the number of accurate answers given in the shortest amount of time. Our criteria for recruiting participants were that they have some experience watching video tutorials and have some experience using Photoshop. Out of the 18 participants, seven participants had less than one year experience with Photoshop, five participants had more than three years of experience and the rest of them had one to three years experience. Additionally, six of the 18 participants watched video tutorials daily, five participants watched video tutorials weekly and rest watched video tutorials monthly.

5.2 Apparatus

In this experiment, we used a 3.4 GHz Intel Core i5 Windows 7 desktop with 8 GB of RAM, on a 24 inch monitor with 1920x1080 resolution. The interfaces were shown in the Firefox web browser.

5.3 Interfaces

We experimented with three interfaces:

- **Traditional Interface:** This is the baseline interface (see Figure 5.1). This interface is similar to the commenting interface of the popular video sharing site YouTube. In this interface, comments are arranged in reverse-

chronological order below the video. Also, if a comment points to a particular time of the video then that time is hyperlinked within the comments (see Figure 5.1(A)). If a user clicks that hyperlinked time then the interface will point to the exact time of the video. This interface was introduced to the participant as the ‘Traditional’ system.

- **Timed Interface:** This system contains only the timed comment anchors attached to the seekbar of the video, but does not have the categorization of comments (see Figure 5.2). This interface was introduced to the participants as the ‘Timed’ system.
- **VidComm Interface:** This interface contains timed comment anchors attached to the seekbar of the video and the categorization of comments which are positioned beside the video (see Figure 5.3). This interface was introduced to the participants as the ‘Categorized’ system.

In each interface, each comment had an ID that participants could use to identify comments.

5.4 Video Tutorials and Comments

We selected three Adobe Photoshop video tutorials for this study. We chose Photoshop because it is very popular. Also, there are many video tutorials available for Photoshop and users actively participate in posting comments in these tutorials. The videos used in this study were collected from YouTube (see

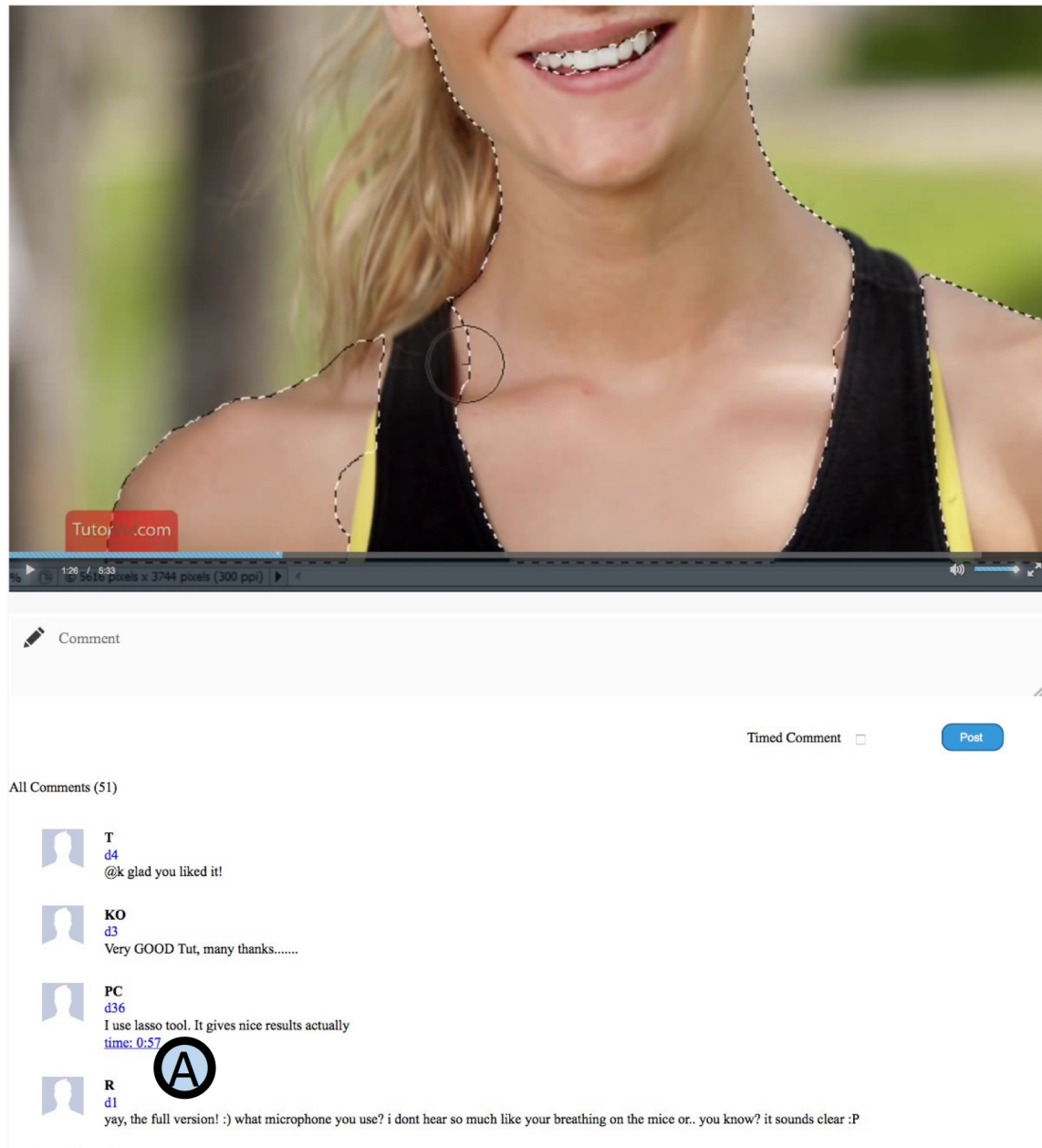


Figure 5.1: Traditional interface: (A) time is hyperlinked within comments

Table 5.1). While selecting the tutorials from YouTube, our criteria were the following:

- The tutorials must have at least 100 comments because we wanted to see

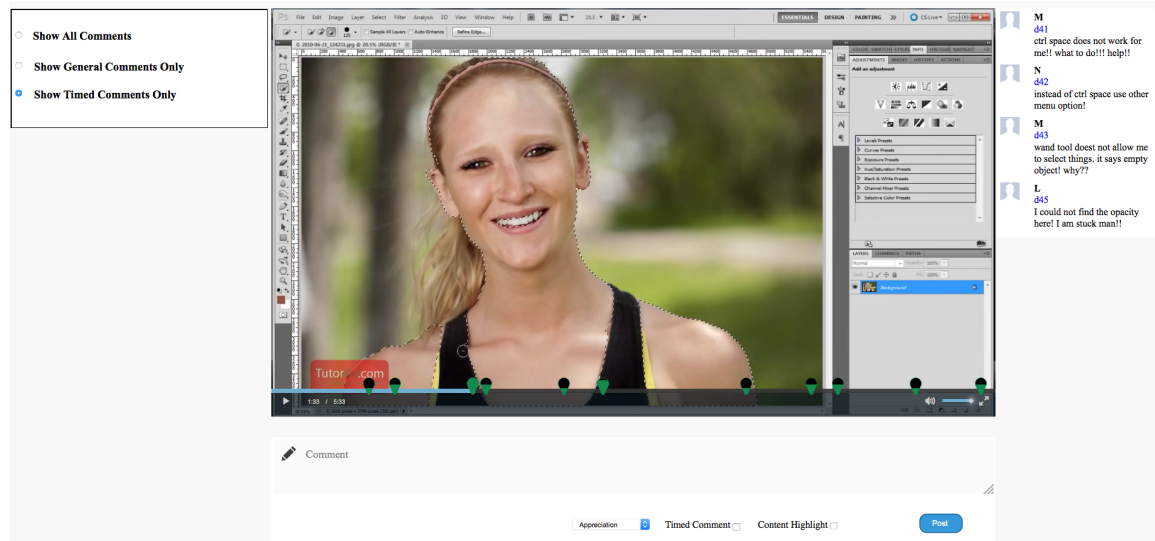


Figure 5.2: Timed interface

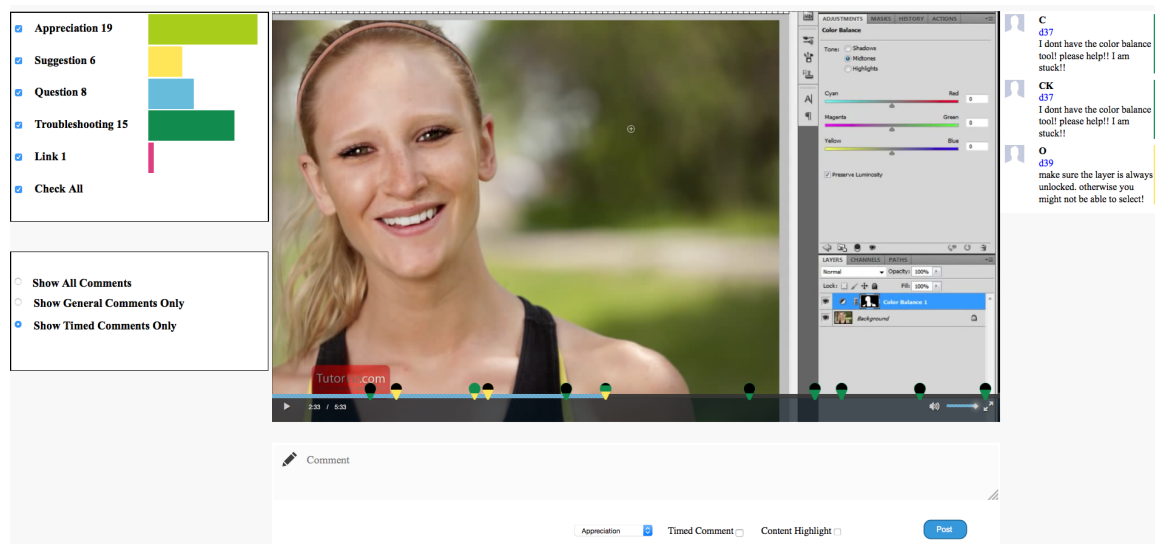


Figure 5.3: VidComm interface

whether the VidComm interface can properly organize a large number of comments. However, we did not select videos with more than 300 comments because it would have been difficult for the participants to browse a large number of comments within the study duration.

- The task described in tutorials had to be different from each other, because if we had selected video tutorials that illustrated similar tasks, then these tutorials might have contained similar type of comments. So, in order to mitigate learning effects, the tutorials were different from each other.

Table 5.1: List of video tutorials

Tutorial Description	Length	Number of Comments*
Putting two pictures together	5:39	235
Fire text effect	6:00	123
Splatter effect in a photo	6:39	115

* As of May 15, 2015

For each tutorial, we took the first 115 comments and balanced the categories of the comments. If there was not sufficient number of comments in each category then we looked into rest of the comments and balanced the number of comments in each category. Finally, if there were not enough comments in different categories in the original comment list, we added comments using similar style and terminology used in the comments collected from YouTube. In the final list, each of the video tutorials had 115 comments. The thesis author hand-coded the comment categories. The distribution of comments in different categories for each video is shown in Table 5.2.

5.5 Study Design

We conducted a 3x3 within-subject user study. Each user had to watch three different video tutorials in three different interfaces and complete three different

Table 5.2: Distribution of comments

Tutorial Description	Total	Appreciation	Question	Troubleshooting	Suggestion	Link
Put Two pictures Together	115	49	17	34	12	3
Fire Text Effect	115	49	17	35	12	2
Splatter Effect from a Photo	115	49	16	35	12	3

tasks in each of the interfaces. So, for each system, the participants had to watch one video tutorial with comments and complete three tasks. Here, the interface was the independent variable which had three levels. The order of the interfaces and video tutorials were counterbalanced using a latin square. The task order was fixed.

5.6 Tasks

When creating the tasks, we tried to develop realistic scenarios where both authors and users of the video tutorials might be looking to find particular comments from the comment section. The first two scenarios were from the user's perspective and the final scenario was from the author's perspective. For the first task, we considered a scenario where a user might be looking for some suggestion comments as he/she was trying to do the tutorial using a different version of Photoshop than the one being shown in the tutorial. In the second scenario, we assumed that the same user had started doing the task and faced some problem

with one of Photoshop's command. In this situation, the user wanted to find some comments that mentioned some problem with the same command. For the final task, we considered a scenario where the author might want to find out the sections specified by time of the video where commenters had mentioned some problems, so that the author could provide some solutions or improve the tutorial in future versions. For each of the first two tasks, participants were given 5 minutes and for the third task the participants were given 10 minutes. The participants had to write down the corresponding relevant comments on paper. The instructions along with the task descriptions are presented in Table 5.3.

Table 5.3: Description of the tasks

Task #	Description	Time	Instructions
Task 1 Suggestion comments	Assume you are a user who is trying to do a fire effect on text using Photoshop CS5 but the tutorial that you have found is for Photoshop CS6. Now, you need to find out if there are any comments that have some suggestion to do the tutorial in Photoshop CS5. Please write down the comment id for any comments that are relevant. You will have 5 minutes for it. (For different video tutorial the versions of Photoshop was different. e.g., Elements 13)	5 min	Find comments and write only id(s) of the comments

Table 5.3: Description of the tasks

Task #	Description	Time	Instructions
Task 2 Problematic commands	Now, assume you have started doing a fire effect on text using this same video tutorial but while following the steps you are having difficulties with the command 'layer style'. So, you've decided to look into the comment section in order to find comments that have mentioned some problems with the command 'layer style'. Please write down the comment id for any comments that are relevant. You will have 5 minutes for it. (For different video tutorials the commands were different in the questions. e.g., brush)	5 min	Find comments and write only id(s) of the comments
Task 3 Problematic sections	Now, you assume that you are the author of the tutorial and you'd like to work on improving the tutorial video. You as an author are interested to know where users are having problems with the tutorial and what types of problems they are having. You will need to write down the times in the video where users are having difficulty, the nature of the problems, and the relevant comment ids. You will have 10 minutes for this task. (This question was same for each video tutorials.)	10 min	Find comments and write time, id(s) and nature of the problems mentioned in the comments

5.7 Procedure

At the beginning of the study, the experimenter introduced the first interface to the participants with the comments and a video tutorial. The videos and the comments used in the demo were different from the comments and the videos used in the study. Then the participants were given five minutes to familiarize themselves with the interface. After that, the participants were given the first task and when they were ready, the experimenter started the timer. For each task, the time was measured separately. This same procedure was repeated for the next two tasks and also for the rest of the 2 interfaces where participants completed the same 3 tasks with different video tutorials and comments.

After completing each task, participants were asked to complete a modified 20-point NASA-TLX questionnaire (see Table B.1) to measure their perceived mental work load. After completing all tasks in the three interfaces, participants were asked to complete another questionnaire related to their subjective preference of the interfaces (i.e., which one they would rate the most preferable and which one as the least preferable). Lastly, the thesis author conducted a semi-structured interview (interview questions are in Appendix B.3) where the participants talked about their experience with the three interfaces, what they liked and disliked and what additional features could be added in order to improve the user experience. The length of the study was less than 90 minutes. An example of the study procedure is given in Figure 5.4.

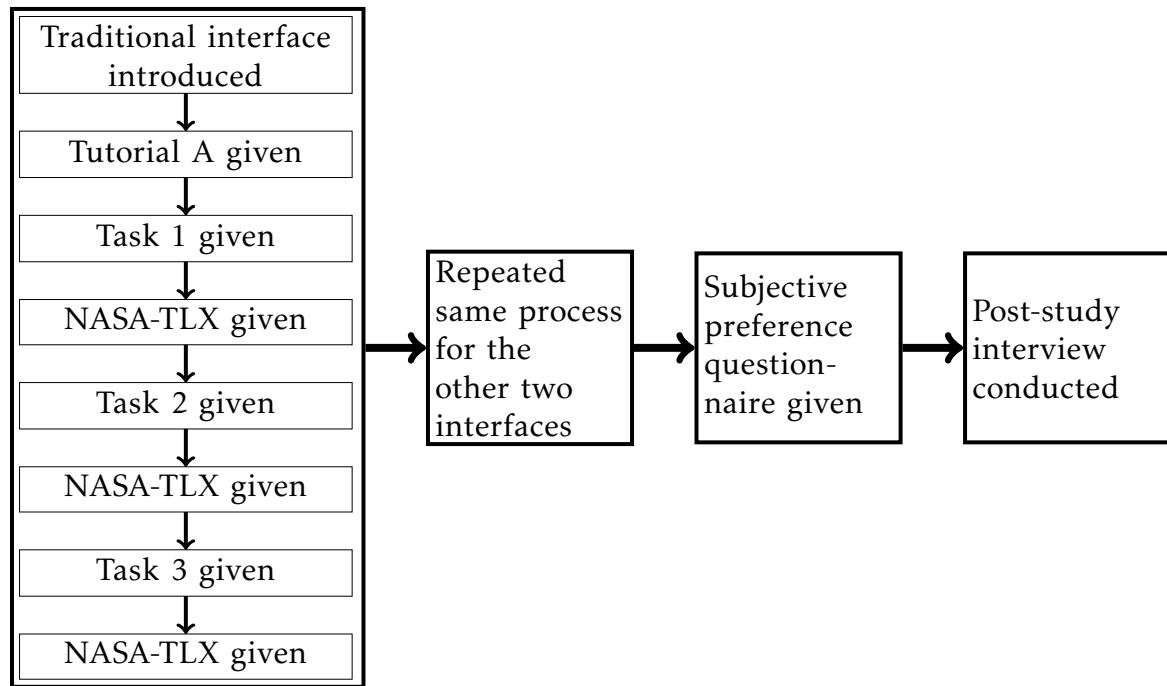


Figure 5.4: Diagram of the study procedure for a participant

5.8 Dependent Measures

In our analysis, our dependent measures were task completion time and accuracy of the answers that the participants had written down. In summary, we measured the following dependent variables:

- **Task completion time:** time taken to complete each task
- **Accuracy of the tasks:** accuracy of answers written by the participants for the tasks (coding rules are described in Appendix B.1)

5.9 Results

We analyzed the dependent measures using a Repeated-Measures Anova with *Interface Type* (i.e., *Traditional*, *Timed* and *VidComm*) as a within-subjects factor. We included *Interface Order* ((i.e., *Traditional-Timed-VidComm* (Tr-Ti-Vi), *Timed-VidComm-Traditional* (Ti-Vi-Tr) and *VidComm-Traditional-Timed* (Vi-Tr-Ti)) as a between-subjects factor. All error bars in the graphs are standard error. We applied the Greenhouse-Geisser adjustment for the data that violated the assumption of sphericity. We also used the Bonferroni adjustment in our post-hoc pairwise comparisons. In this report, we present our measures as significant if $p < .05$ and as a possible trend if $.05 < p < .1$. Moreover, we report eta squared (η^2) as a measure of effect size. In our report, we consider .01 a small effect size, .06 a medium effect size and .14 a large effect size according to Cohen's guidelines [11].

5.9.1 Task Completion Time

We begin our analysis with the task completion time. The overall completion time for the three tasks (i.e., the summation of completion times of the three tasks excluding the task intervals) and the completion times for each task individually are graphically represented in Figure 5.5. It is to be noted here that some of the participants could not complete the tasks within the given time limit. For these cases, the completion times were equal to the given time for the tasks (i.e., 5 minutes for the first two tasks and 10 minutes for the last task).

For the overall task completion time, we found a significant main effect of *Interface Type* ($F_{2,30} = 5.679$, $p = .008$, $\eta^2 = .275$). After analyzing the pairwise

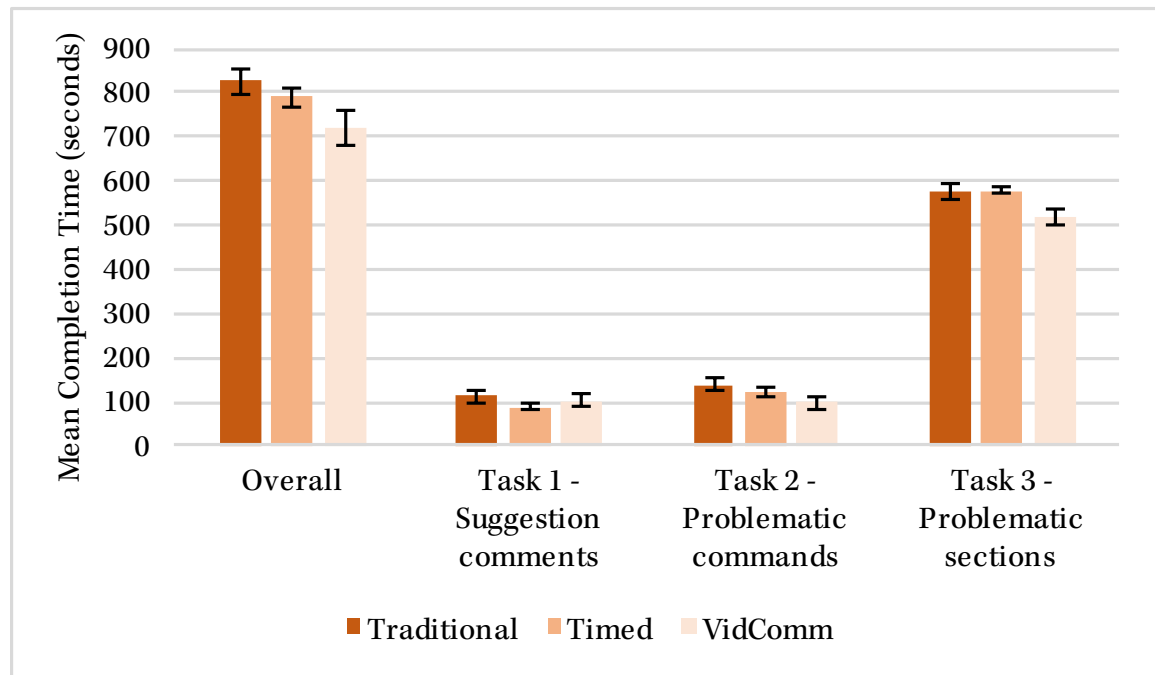


Figure 5.5: Task completion time. Error bars are standard errors.

comparisons (see Table 5.5), we found that the participants performed the tasks 105.98 seconds faster on average with the *VidComm* interface compared to the *Traditional* interface ($p = .009$). However, between the *Traditional* and the *Timed* interface, we found no significant difference in the task completion time ($p = .753$). Also, between the *Timed* and the *VidComm* interface, there was no significant difference ($p = .196$).

We also found a significant *Interface Type* × *Interface Order* interaction effect on overall task completion time ($F_{4,30} = 3.443$, $p = .020$, $\eta^2 = .315$). As illustrated in the Figure 5.6, overall, participants completed the tasks faster in the *Timed* interface and the *VidComm* interface compared to the *Traditional* interface when they interacted with the *Traditional* interface at first. We suspect that in order to

get the benefits of the timed comments and the categorization of comments, the participants might need to have some experience with the tasks and the comments in a interface they are familiar with (i.e., *Traditional* interface).

Table 5.4: Main effect of *Interface Type* on task completion time

Task no	Mean (Std. Error)			$F_{2,30}$	p	η^2
	Traditional	Timed	VidComm			
Overall	827.53 (27.85)	790.57 (21.07)	721.54 (40.60)	5.679	.008*	.275
Task 1 ¹	117.71 (11.23)	87.91 (6.98)	103.94 (15.28)	2.302	.117	.133
Task 2 ²	140.31 (12.75)	123.12 (12.12)	100.40 (14.00)	3.151	.057	.207
Task 3 ³	575.51 (16.54)	579.54 (7.96)	517.20 (19.24)	6.703	.004*	.309

* Significant at the 0.05 level

¹ Suggestion comments, ² Problematic commands, ³ Problematic sections

We also looked into the individual task completion time (see Table 5.4). For the first task (suggestion comments), we found no significant main effect of *Interface Type*. We found a possible trend for the completion time of the second task (problematic commands). The trend indicates that the participants might have performed this task faster in the *VidComm* interface compared to the other two interfaces. For the completion time of the third task (problematic sections), we found a significant main effect of *Interface Type* ($F_{2,30} = 6.703$, $p = .004$, $\eta^2 = .309$). The pairwise comparisons (see Table 5.5) for the completion time of task 3 (problematic sections) indicates that the participants on average took 62.33 seconds less to complete the task with the *VidComm* interface compared to the *Timed* interface ($p = .004$). Also, for this pairwise analysis we found a possible trend that the participants might be faster with the *VidComm* interface compared to the *Traditional* interface ($p = .061$). However, between the *Traditional* and the

Timed interface there was no significant difference ($p = 1.000$).

In summary, while completing the third task (problematic sections), participants were significantly faster in the *VidComm* interface compared to the *Timed* interface. Also, for this task, a possible trend indicates that the participants performed the task faster in the *VidComm* interface compared to the *Traditional* interface.

Table 5.5: Pairwise comparisons for overall and task 3 (problematic sections) completion time

Interface (i)	Interface (j)	Mean Difference (i-j)	Std. Error	Sig.
Overall completion time				
Traditional	Timed	36.96	30.95	.753
Traditional	VidComm	105.98*	29.90	.009
Timed	VidComm	69.03	34.71	.196
Task 3 (problematic sections) completion time				
Traditional	Timed	-4.03	18.39	1.000
Traditional	VidComm	58.30	22.49	.061
Timed	VidComm	62.33*	15.65	.004

* The mean difference is significant at the 0.05 level.

Moreover, we found a significant *Interface Type*×*Interface Order* interaction effect on the completion time of task 1 (suggestion comments) ($F_{4,30} = 3.131$, $p = .029$, $\eta^2 = .294$). This interaction effect (see Figure 5.7) can be explained in the same way we have described the interaction effect of *Interface Type*×*Interface Order* on overall task completion time. For the second (problematic commands) and the third (problematic sections) task there were no significant *Interface Type*×*Interface Order* interaction effects on the completion time (see Table 5.6).

Table 5.6: *Interface Type*×*Interface Order* interaction effect on task completion time

Task no	$F_{4,30}$	p	η^2
Overall	3.443	.020*	.315
Task 1 - Suggestion comments	3.131	.029*	.294
Task 2 - Problematic commands	1.687	.179	.184
Task 3 - Problematic sections	1.957	.127	.207

* Significant at the 0.05 level

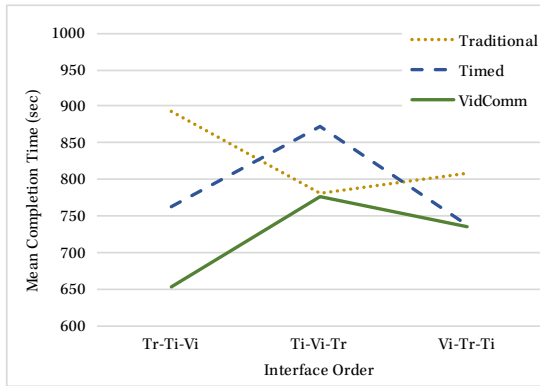


Figure 5.6: Interaction effect on overall task completion time

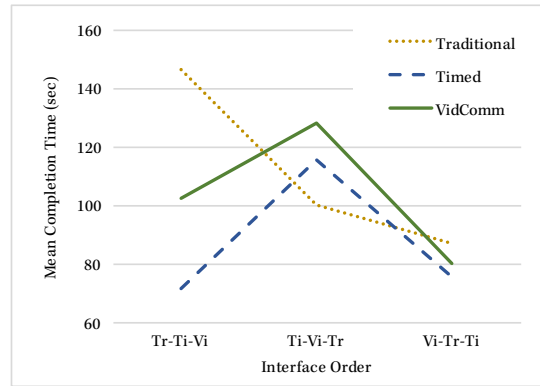


Figure 5.7: Interaction effect on task 1 (suggestion comments) completion time

5.9.2 Accuracy of the Tasks

Now, we present our analysis of the accuracy of the answers that the participants have written on paper for the tasks. The overall accuracy (i.e., accuracy of the answers for three tasks) and the accuracy of each individual task are shown graphically in Figure 5.8.

From the analysis, we found a significant main effect of *Interface Type* on the overall accuracy ($F_{1,464,21.963} = 14.977$, $p < .001$, $\eta^2 = .500$). After analyzing the pairwise comparisons on overall accuracy, we found significant differences for each of the comparisons (see Table 5.8). We have found that participants

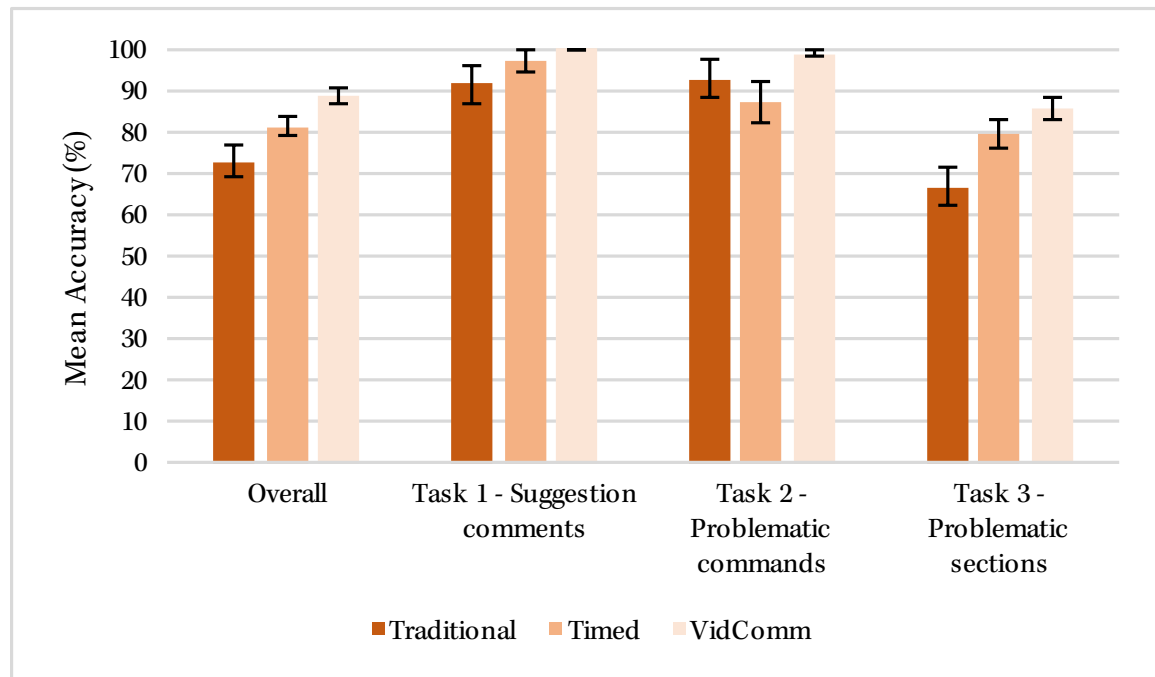


Figure 5.8: Task accuracy. Error bars are standard errors.

were 8.30% more accurate on average with the *Timed* interface compared to the *Traditional* interface ($p = .012$). Also, the participants were 15.93% more accurate on average with the *VidComm* interface compared to the *Traditional* interface ($p = .002$). Moreover, the participants were 7.62% more accurate on average with the *VidComm* interface compared to the *Timed* interface ($p = .020$).

Additionally, there was a significant *Interface Type* × *Interface Order* interaction effect on overall accuracy ($F_{2,928,21.963} = 5.470$, $p = .006$, $\eta^2 = .422$). This interaction effect is similar to the interaction effect on overall completion time (see Figure 5.9). We think that the potential advantages of the *Timed* interface and the *VidComm* interface were available to the participants when they had some exposure to the tasks and comments in a familiar interface like the *Traditional* one.

Table 5.7: Main effect of *Interface Type* on task accuracy

Task no	Mean (Std. Error)			$F_{2,30}$	p	η^2
	Traditional	Timed	VidComm			
Overall	72.99 (3.83)	81.29 (2.23)	88.92 (2.05)	14.977 [†]	<.001*	.500
Task 1 ¹	91.66(4.81)	97.22 (2.77)	100 (0.00)	1.667 [‡]	.215	.100
Task 2 ²	92.98 (4.65)	87.56 (4.93)	99.20 (.79)	2.450	.103	.140
Task 3 ³	66.78 (4.41)	79.84 (3.59)	85.54 (2.68)	15.814	<.001*	.513

* Significant at the 0.05 level

[†] $F_{1.464,21.963}$, [‡] $F_{1.336,20.045}$

¹ Suggestion comments, ² Problematic commands, ³ Problematic sections

We have also analyzed the main effect of *Interface Type* on accuracy for individual tasks. For the first (suggestion comments) and second task (problematic commands), there were no significant main effect of *Interface Type* on the accuracy of the tasks (see Table 5.7) and also no *Interface Type*×*Interface Order* interaction effect on the accuracy of the tasks (see Table 5.9). For the third task there was a significant main effect of *Interface Type* on accuracy ($F_{2,30} = 15.814$, $p < .001$, $\eta^2 = .513$). We also performed a pairwise comparison for the third task (problematic sections) (see Table 5.8). We found that between *Traditional* interface and *Timed* interface, the participants were 13.06% more accurate on average with the *Timed* interface ($p = .001$) and between the *Traditional* and the *VidComm* interfaces, the participants were 18.75% more accurate on average with the *VidComm* interface ($p = .001$). However, between the *Timed* and the *VidComm* interface there was no significant difference.

Moreover, we found a significant *Interface Type*×*Interface Order* interaction effect on the accuracy of the third task (problematic sections) ($F_{4,30} = 3.674$, $p = .015$, $\eta^2 = .329$). This interaction effect (see Figure 5.10) can be explained in

the similar way we have described the interaction effect of *Interface Type*×*Interface Order* on overall accuracy.

Table 5.8: Pairwise comparisons for overall and task 3 (problematic sections) accuracy

Interface (i)	Interface (j)	Mean Difference (i-j)	Std. Error	Sig.
Overall accuracy				
Traditional	Timed	-8.30*	2.44	.012
Traditional	VidComm	-15.93*	3.68	.002
Timed	VidComm	-7.62*	2.41	.020
Task 3 (problematic sections) accuracy				
Traditional	Timed	-13.06*	2.93	.001
Traditional	VidComm	-18.75*	4.07	.001
Timed	VidComm	-5.69	3.14	.271

* The mean difference is significant at the 0.05 level.

Table 5.9: *Interface Type*×*Interface Order* interaction effect on task accuracy

Task no	$F_{4,30}$	p	η^2
Overall	5.470 [‡]	.006*	.422
Task 1 - Suggestion comments	1.667 [†]	.215	.100
Task 2 - Problematic commands	.153	.153	.194
Task 3 - Problematic sections	3.674	.015*	.329

* Significant at the 0.05 level

[†] $F_{1,336,20.045}$, [‡] $F_{2,928,21.963}$

Additionally, we found that participants wrote comments that did not match the answers for each tasks. We analyzed the percentage of these additional comments[†] for each task individually. For the first (suggestion comments) and second (problematic commands) task, we did not find any significant main effect of *Interface Type* on the mean percentage of additional comments. However, for the

$$^{\dagger} \text{ percentage of additional comments} = \frac{\text{number of additional comments}}{\text{total number of comments written by a participant}}$$

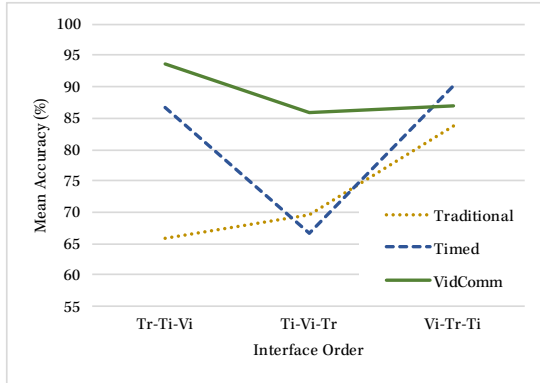


Figure 5.9: Interaction effect on overall accuracy

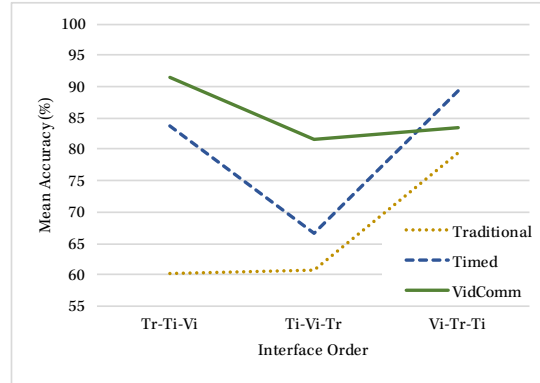


Figure 5.10: Interaction effect on task 3 (problematic sections) accuracy

third task (problematic sections), there was a significant main effect of *Interface Type* on the mean percentage of additional comments ($F_{4,30} = 8.299$, $p = .001$, $\eta^2 = .356$). We also performed pairwise comparison for the third task (problematic sections). We found that, participants on average wrote 8.9% more additional comments in the *Traditional* interface compared to the *VidComm* interface ($p = .004$). Between the *Timed* and *VidComm* interface, we found that participants wrote 7.2% more additional comments on average in the *Timed* interface compared to the *VidComm* interface ($p = .013$). However, between the *Traditional* and *Timed* interface, the difference in the mean percentage of additional comments was not significant ($p = 1.000$).

5.9.3 Perceived Mental Workload

After completing each task, the participants had to fill up a 20-point NASA-TLX [21] (see Table B.1). We took the average of the NASA-TLX sub-scale for the three tasks in each interface and analyzed them (see Table 5.10). We found

a possible trend in the sub-scale ‘Frustration’ that indicates that the participants might have felt less frustrated in the *VidComm* interface compared to the other two interfaces. Otherwise, there was no significant main effect of *Interface Type* on any of the sub-scales.

Table 5.10: Perceived mental workload according to the NASA-TLX sub-scales

Mental Workload	Mean			$F_{2,30}$	p	η^2
	Traditional	Timed	VidComm			
Mental Demand	6.14	5.61	4.70	1.601	.218	.096
Physical Demand	4.88	4.48	4.13	.986	.385	.062
Temporal Demand	6.29	7.09	5.88	.938	.402	.059
Performance	4.50	4.20	4.33	.114	.892	.008
Effort	5.98	5.74	4.33	2.632 [†]	.119	.149
Frustration	5.03	5.24	3.85	2.773	.079	.156

[†] $F_{1.159,22.922}$

To the original six sub-scales we added two sub-scales ‘Finding Comments’ and ‘Organization’ because we wanted to know how much each interface helped participants in finding the comments and also how much the organization of comments helped the participants to complete the tasks. We found significant main effect of *Interface Type* on these two sub-scales (see Table 5.11). We also performed post-hoc pairwise analysis for these two additional sub-scales (see Table B.2). There was no significance in the pairwise comparisons for the ‘Organization’ sub-scale. For the ‘Finding Comments’ sub-scale, participants felt that the *VidComm* interface was more helpful for finding comments compared to the *Traditional* interface ($p = .026$). Moreover, there was a trend suggesting that participants felt the *VidComm* interface was more helpful for finding comments

compared to the *Timed* interface ($p = .092$). However, between the *Traditional* and *Timed* interfaces there was no significant difference ($p = .111$).

Table 5.11: Perceived mental workload for additional sub-scales

Mental Workload	Mean			F	p	η^2
	Traditional	Timed	VidComm			
Finding Comments	5.01	4.29	2.75	7.458 [†]	.009*	.332
Organization	5.57	4.27	2.85	4.060 [‡]	.048*	.213

* Significant at .05 level

[†] $F_{1.270,19.057}$, [‡] $F_{1.325,19.870}$

5.9.4 Subjective Preference

After completing all the tasks, participants completed a questionnaire about their subjective preferences of the interfaces, where we asked which system they preferred overall and which system helped them the most in finding comments. We found that participants responded positively towards the *VidComm* interface for both of the cases. For overall preference, 12 out of 18 participants preferred *VidComm* ($\chi^2 = 25.667$, $p < .001$) and for finding comments 16 out of 18 participants preferred *VidComm* ($\chi^2 = 75.000$, $p < .001$) (see Table 5.12).

Table 5.12: Participants subjective preference

Criteria	Ranked 1 st Frequency			df	χ^2	Sig.
	Traditional	Timed	VidComm			
Overall Preference	1	5	12	4	25.667	< .001*
Finding Comments	1	1	16	4	75.000	< .001*

* Significant at the 0.05 level

5.9.5 Qualitative Data

At the end of the session, we conducted a semi-structured interview where participants were asked about their preference among interfaces and which features they liked in each interface and which they did not. As we describe below, the participants liked the categorization of comments, the timed comments and the integration of categories in the anchors. Moreover, some participants provided some feedback on how to improve the *VidComm* interface.

Different Categories of Comments

The majority of the participants preferred the *VidComm* interface because of the categorization feature. They liked it because they did not have to read each comment in order to find out which comment falls into which category.

[..] The third system (VidComm) was really well made. I did not have to read the whole comment to know whether it is a problem or a question because it is categorized. - P10

[..] For the first system (Timed) I did not understand whether a comment was mentioning some suggestions or problems. In the second system (VidComm) I did not find any problem because it was color coded. - P4

Participants also expressed that this categorization of comments creates a better organization of comments.

[..] I found it very useful. It creates a lot of organization. If they had that in YouTube then I would be able to sort things and find the comments that I

have been looking for. - P13

Timed Comment

Participants found the timed comment feature useful as it allows users to look for comments on a particular section of the video instead of watching the whole video or reading the whole comment section.

[..] I have a problem with a particular section and there is a timed comment over there then I just do not have to go through all these comments. I just click over there and I am done. I have answer right away. - P3

[..] It makes video searching easy. For example if I am going through a tutorial and looking for a specific problem, if I am not having timed comment then I have to go through whole video but this timed comment would make me find those question and answer very quickly. Therefore, I will go to that section and do not have watch the whole video at all. It will save my time. - P15

[..] On a specific location of the video what people are actually saying about that specific frame or specific event that is good because you can jump to that part otherwise you have to scroll through all the comments. - P5

Integrating Different Categories in the Seekbar

Participants also liked the idea of using color to integrate different categories within the anchors in the seek-bar. This allows them to know which part has what type of comments.

[..] In the second one (VidComm) there are colors inside it, so you can see what type of comments there are inside the section. - P6

[..] I like the filling up balloons which gives me an idea of how many questions are there in each section. - P2

Also, this feature might help people find out the solution of problems that they might face while watching the video tutorial.

[..] For the people who are actually looking for a specific solution the anchor system is good for them to go in the problem in a quick and faster way and click on the anchor and see what is going on there. [..] - P8

Improvement of VidComm

Participants provided valuable feedback on how the *VidComm* interface can be improved. For example, one participant who preferred the *VidComm* interface said that somehow marking the solution of problems would have been really helpful.

[..] What I found in the troubleshooting is that there are questions and there are answers. So, I could not differentiate which one was the question and which one was the answers. Highlighting the solution would have been helpful. [..] - P2

Moreover, one participant mentioned that making different components of the *VidComm* interface closer will improve the initial familiarization with the system.

I want the first system (VidComm) a little bit easier to get people familiar with. On one screen when you have to move your eye a greater distance from one corner to the other corner it actually creates toll on your brain. Therefore, if these were closer then you do not have to use your eyes that much. - P15

5.10 Discussion

Our evaluation of the VidComm interface provides encouraging evidence that this approach might be beneficial for finding comments in certain conditions. Our analysis of the timing and accuracy data suggests that the organization of VidComm helped the participants complete the tasks quickly and accurately compared to the other two systems. However, our study also suggests that these advantages might primarily occur when the users are looking for comments that are related to particular sections of the video, and for comments that are mentioning some problems or suggestions. In the post-study interview, the participants said that the color categorization helped them find comments but our analysis indicates that when the users are searching comments with a keyword, the native find feature (Ctrl+F) of the browsers might be good enough to locate the desired comments.

From our semi-structured interviews and the subjective preference data, we found that most of the participants were enthusiastic about the VidComm interface. During the interview, the participants felt that VidComm makes searching for information in the comment section easy by allowing the users to filter

comments. In traditional systems, there is no option for filtering comments, therefore, users have to go through all the comments in order to find a piece of information. Moreover, the participants also indicated that the categorization of comments enabled them to know which part of the tutorial is getting what types of comments which would help viewers find timed comments related to specific categories.

The purpose of our study was to see how the participants interacted with the different components of the VidComm interface. This study allowed us to understand whether the VidComm interface helped the users while seeking information from comments. One of the major limitations of this approach is that in this user study, the participants were not doing any task in the application while following the tutorial, which would have been a more ecologically valid approach. However, asking the participants to do some tasks in an application while following tutorials in different interfaces would pose a number of challenges. First, participants' skill-sets would have been a factor. If a participant is an expert in the application then he/she might not look into the comments at all. This would not allow us to know whether the participants had found different features of the VidComm interface (e.g., timed comment, categorization of comments) useful or not. Secondly, a participant might totally ignore the comments after getting stuck on a problem. For example, the participants could arbitrarily try some new commands in the application to solve the problem. Therefore, to ensure that the participants had to interact with the comments, we chose this method of user study instead of asking participants to do some tasks in the application while

following tutorials in different interfaces. As we have found promising initial evidence that VidComm helps users navigate comments, in the future, the next logical study would be to ask participants to complete some tasks in an application while following tutorials in VidComm.

In the future, we would like to deploy VidComm in the real world in order to see whether people will find this system useful for finding comments or for completing a task by following video tutorials in VidComm. One of the biggest challenges of deploying VidComm will be to encourage people to post timed comments in this type of commenting interface. If there are not enough timed comments then the users will not get all the benefits of VidComm.

5.11 Summary

In this chapter, we have presented the user study that we conducted to evaluate the VidComm interface against the Traditional and Timed interface. This study involved measuring the effects of the timed comment feature and the categorization of comments feature on participants' task completion time and task accuracy. We found that if the users are looking for comments that are linked with the time of the video then the VidComm interface is more useful than the Traditional interface. Our subjective data suggests that the participants in general preferred the VidComm interface compared to the other two interfaces.

Chapter 6

Conclusion

Video tutorials contain comment sections where viewers can provide their feedback on different aspects such as: suggesting new techniques, mentioning problems while following tutorials, etc. In existing video tutorial systems these comments are presented in separate threads below the video. This separation of video tutorial and comment section creates cognitive load on users when they try to relate comments with videos [37]. In this thesis, we qualitatively analyzed the comments posted below video tutorials in order to understand how people are using the comment section. Following this, we designed and implemented a video tutorial commenting system called ‘VidComm’ that allows users to personalize comments according to their information needs. An evaluation of the VidComm interface suggests that VidComm helped the participants find information more quickly and accurately compared to a traditional commenting interface.

6.1 Contributions

The first contribution of this thesis is the qualitative analysis conducted on the comments posted below YouTube video tutorials. From the analysis we found that people use video tutorials and their corresponding comment sections in the same way people use text- and image-based tutorials and related comment sections. Our analysis indicates that people post various types of comments in video tutorials. Moreover, people post comments that point to particular times of the video and tutorial contents.

Our second contribution is the design and implementation of the VidComm interface. VidComm augments existing video tutorial commenting systems by allowing users to filter comments from different categories. Additionally, using this system, viewers can visually link comments with corresponding tutorial contents.

The final contribution is a formal laboratory evaluation with 18 participants, where we explored the impact of VidComm on user experience while finding particular information from comments. The results suggest that, overall, VidComm helped the participants find information from the comments quickly and more accurately than a traditional commenting interface. Moreover, subjectively, the participants preferred the VidComm interface.

6.2 Limitations and Future Work

Although from the laboratory experiment we have found promising results in favour of VidComm, there are some limitations of our approach. Our analysis also suggests some promising avenues for future research.

One of the major limitations of this thesis is the user study that we have conducted to evaluate VidComm. In the user study, the participants did not perform any tasks using an application, which would have been a more ecologically valid approach. Instead, we chose a study approach where participants had to interact with the comments. This method allowed us to evaluate different components of VidComm more closely. As our evaluation suggested promising results, a logical next step would be to conduct a user study where participants might be asked to complete tasks in applications while following tutorials on different commenting interfaces.

In our user study we did not focus on whether VidComm helps users select particular tutorials. In future, we would like to conduct a study to understand whether VidComm has any impact on tutorial selection. For example, we want to explore the impact of the number of comments in different categories (e.g., troubleshooting, appreciation, etc.) on users' tutorial selection.

Previously, there has been a number of research projects on integrating crowdsourced help in the application [10, 36]. Also, researchers have designed systems that integrate video tutorials and search engine results with different commands of applications [19, 15]. So, we think future research could be done on exploring different designs of integrating comments with different tools of

applications.

Moreover, from our qualitative analysis we have found that some users follow tutorials to improve their skills. These users are enthusiasts or professionals who watch tutorials to improve their repertoire of skills. So, to support this set of users, we would like to investigate whether we can create a system that recommends tutorials based on the nature of the comments.

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Appendix A

Qualitative Analysis

Table A.1: Coding scheme with examples

Code	Description	Example
Thanking the author		I just spent the weekend editing a series of composite layered images and you showed me two tricks I could have used during that process, I always enjoy seeing vids like this, thanks Mike!!
Praise and encouragement		Great job! Hope I can do something like that! THANX!!
Comments on the sound (background music or narrator's voice)		I know that song That's 'kalimba' Right????

Table A.1: Coding scheme with examples

Code	Description	Example
Discussing the application	Author or viewers discussing different features of the applications or about different versions of the applications or alternatives of the applications.	Photoshop elements is basically photoshop for people who aren't willing to learn professional photoshop. Its a way to get professional results without the hassle of learning a lot of technical things. It doesn't have as many features and its pretty simple to use however you can still make great things. If you are going to school for this particular thing I recommend you get the normal photoshop like CS4 Elements 8 costs around \$100 and CS4 costs about \$700 or extended for \$1000
Mentioning a specific version of the application		This is Photoshop CS6 however any photoshop will do this. You could also use Elements but might need to import a layer mask from another file.
Mentioning a problem or failing while following the tutorial	Viewers describing different problems that they faced while following the tutorial	this fails. half the problem to getting two images together is actually putting them on the same file u dont even explain that u just take the tiger image and put it with the apple.
Discussing the end results of the tutorial technique	Users discussing about the final outcome after following the tutorial.	Thanks for the info. After I numbered the pages, the document gets sort of semi-whited out, as though I haven't finished making my selection, but I did. Why does it do that?

Table A.1: Coding scheme with examples

Code	Description	Example
Request for clarification (e.g. of tutorial step or another user's comment)		Im sry i don't speak English a lot can you tell me what you said at 4:08 click control and what? Tnx
Provide clarification where user faced problem		The move tool, you can click V on your keyboard to be taken to it. Make sure you've selected "Show Transform Tools" to resize your image.
Out of context comments	Comments that have no relation with the tutorial.	NINJA TUNA!!:D
Responding to another user	General response to another user by the author or a user.	@Keatonklown press the button at the top left and go to print, and make sure you preview it so u can see if ur printing it correctly, and then just pront-make sure you have a printer connected and installed
Negative comment (from both user and author)	Comments containing swearing or slangs	Wow...you suck at photoshop. Just throwin' it out there.
Questions related to the tutorial	Questions those have relations with the tutorial.	Does anyone know how to draw a graphic using an equation, like $y=12x+3$? I realy need to know this thx
Post from the author		I thank everyone who watched this video and commented. I really appreciate your comments, they pay off all the hard work of putting these videos together. Thanks ALL! -PakiHack-

Table A.1: Coding scheme with examples

Code	Description	Example
Points to a timeframe in the tutorial		LOL at 8:42 “Subscribe it’s totally free *coughcough*”
Contains emoticon or internet slang		Emoticon
Providing tips or advice related to the tutorial		Very nice! Thank you for all the help. One thing though what about the =SUM(*:*) wouldn’t that have worked much easier?
Includes reference to a URL, youtube channel or another website		Hi there, are you familiar with “photo SFX art” (just search on Google for it ...)? On their website you will find a smart free video showing how to shoot incredible pictures. It helped Joe to take photographs that have that jaw-dropping-effect whenever you take a look at them. Hopefully it helps you too.
Questions beyond the process of the tutorial	Questions that is distinct from the process of the tutorial.	how do you make a presentation like this demo? what equipment do you need?
Comment in different language		duten morti mati k nu sti sa folosesti photoshop

Table A.1: Coding scheme with examples

Code	Description	Example
Comments related to download of the software or an artifact used in the application	Those comments which talk about the download of the main application, photo/document used in the tutorial. It might contain a download link or ask for the download link.	do u know how can i download for free photoshopcs5?
Comment related to the artifact used in the tutorial	These comments talk about the artifacts (document, photo, file) used in the tutorial process.	nice picture :D haha. i love Kaulitz :)
Mentioning hardware issue		Your computer is slow while CS4 is processing commands. You need more memory, and/or take working programs off the computer.
Sharing personal experience from using the tutorial or applying some other technique		I attempted to do it in Pixlr, because they are basically the same in my point of view, then it screw me over. So I went to GIMP and THAT piece of .. lagged like hell so I went on Paint.Net and did it. And it actually turned out pretty good! If you don't mind could you look at my new Logo, anyone?

Table A.1: Coding scheme with examples

Code	Description	Example
Comments related to DVD and CD of the tutorial	These are the comments which talk about the DVD or CD of the video tutorial.	Let's face it how many commercials do you see when watching TV? This is the only way to advertise my DVD's and it helps to keep the shows going. Thanks for the comment.
Thanking user(s) for feedback		I thank everyone who watched this video and commented. I really appreciate your comments, they pay off all the hard work of putting these videos together. Thanks ALL! -PakiHack-
Comments related to the physical appearance of the author	Users commenting on the looks of the author	you have a scary face!
Comments related to do a project or an assignment for coursework		You are a life saver. I was stuck on an assignment for like 2 hours, then this video hit everything on the spot. Thanks man
Comments related to the communication with the author or other user	Asking for the email or other way of communication with the author	any chance you can give me your skype need to ask something
Comments related to the length of the video		Sooooooooooooo long I fell asleep the last time I watched this
Refers to the negative comment by a user or the author		@ndps97 Yes YOU failed science, its your fault, now go do something constructive instead of blaming ur failures on other people.

Table A.1: Coding scheme with examples

Code	Description	Example
Request for new tutorial		Thanks so much! You have a new subscriber and fan!!! Could you make a tutorial about Displacement Maps? Thanks again.
Request for help	General comments which ask for help for a task.	Great video...I need help with editing a photo that's proving to be a bit tricky..is there anyway you are able to help?

Table A.2: Percentage of comments for each code

Code	Number of Comments	%	% reported by Lafreniere et al.
Thanking the author	637	45.31	28
Praise and Encouragement	591	42.03	42
Responding to another user	45	3.20	17
Mentioning a problem or failing while following the tutorial	44	3.13	10
Request for clarification (e.g. of tutorial step or another user's comment)	43	3.06	7
Providing tips or advice related to the tutorial	38	2.7	6
Questions beyond the process of the tutorial	26	1.85	12
Discussing the end results of the tutorial technique	5	0.36	6
Sharing personal experience from using the tutorial or applying some other technique	18	1.28	8
Discussing the application	6	0.43	16
Questions related to the tutorial	84	5.97	-
Out of context comments	59	4.20	-
Mentioning a specific version of the application	55	3.91	-
Post from the author	52	3.70	-
Comments related to do a project or an assignment for coursework	51	3.63	-

Table A.2: Percentage of comments for each code

Code	Number of Comments	%	% reported by Lafreniere et al.
Comments on the sound (Background music or narrator's voice)	40	2.84	-
Negative comment (from both user and author)	32	2.27	-
Thanking user(s) for feedback	31	2.20	-
Provide clarification where user faced problem	27	1.92	-
Comment related to the artifact used in the tutorial	23	1.64	-
Contains emoticon or internet slang	18	1.28	-
Comments related to download of the software or an artifact used in the application	16	1.13	-
Comment in different language	14	1.00	-
Refers to the negative comment by user or author	13	0.92	-
Points to a timeframe in the tutorial	12	0.85	-
Comment on the physical appearance or name of the author	5	0.36	-
Comments related to the communication with the author or other user	5	0.36	-

Table A.2: Percentage of comments for each code

Code	Number of Comments	%	% reported by Lafreniere et al.
Comments related to DVD and CD of the tutorial	2	0.14	-
Mentioning hardware issue	2	0.14	-
Comment related to the length of the video	1	0.006	-
Request for new tutorial	10	0.007	-
Request for help	17	0.03	-

Appendix B

Evaluation

B.1 Rules to Measure the Accuracy of the Answers

Here are the following rules we have followed to measure the accuracy of the answers that the participants have written down on paper. It is to be noted that each comment had an ID which the participants had to write down instead of writing the whole comment. Also, all categories of the comments were hand-coded by the experimenter.

- Task 1 (Suggestion comments): For this task the question was - Find those comments that mentioned some suggestion to do the tutorial in a different version of Photoshop (e.g., Photoshop elements 13, CS5 etc.) and write down the id(s) of those comments. We took the answers as correct if the written comments had one of the following phrases:

- I would suggest to do/use(some step or command) in PhotoShop (different version)
 - I have tried this (some step or command) in PhotoShop (different version) and found great/good result
- Task 2 (Problematic commands): The question for the second task was
 - Find those comments (id) that mentioned about some problem with a command (e.g., 'brush', 'content aware' etc.) and write down the id(s) of those comments. If the written comments have one of the following phrases then we took it as correct answers:
 - I am stuck in this step using this command
 - Help me with this command
 - The command is not working
 - I could not find this command/option in my application (PhotoShop or other application)
- Task 3 (Problematic sections): The question for the final task was - Find the times of the video where users have faced problem. Write down the time of the comments, id(s) and the nature of the problems. For this task the answers had to meet all of the following three cafeteria.
 - In each of the interfaces, the comments had the time information embedded with it. If this time information was written then it is a correct answer.

- If the written comments had one of the following phrases then we took it as correct answers:
 - * I am stuck in this step using this command
 - * Help me with this command
 - * The command is not working
 - * I could not find this command/option in my application (PhotoShop or other application)
- If the participant wrote few words about the problems mentioned in the comments then it was taken as a correct answer.

B.2 Perceived Mental Workload

Table B.1: Modified NASA-TLX (20-point scale)

Mental Demand	How mentally demanding was the task?
Physical Demand	How physically demanding was the task?
Temporal Demand	How hurried or rushed was the pace of the task?
Performance	How successful were you in accomplishing what you were asked to do?
Effort	How hard did you have to work to accomplish your level of performance?
Frustration	How insecure, discouraged, irritated, stressed, and annoyed were you?
Finding Comments	How easy was it to find the comments you were looking for?
Organization	How much did the comment organization help you find the comments you were looking for?

Table B.2: Pairwise comparisons for finding comments and organization

Interface (i)	Interface (j)	Mean Difference (i-j)	Std. Error	Sig.
Finding Comments				
Traditional	Timed	.722	.315	.111
Traditional	VidComm	2.259 *	.747	.026
Timed	VidComm	1.537	.644	.092
Organization				
Traditional	Timed	1.296	.894	.503
Traditional	VidComm	2.722	1.235	.131
Timed	VidComm	1.426	.643	.128

* The mean difference is significant at the 0.05 level.

B.3 Post-Study Interview Questionnaire

- How often do you look into comments of the video tutorials?
- If you are stuck in a problem while watching video tutorial, do you look into the comment section for solution?
- How was your overall experience with these systems?
- What problems did you face while performing tasks in each of the systems?
- Does any of the system make you more interested to look into comments of video tutorials?
- Have you ever interacted with timed comment before? Using what system / software? If yes, then how was the experience? If no, then how was experience with it during the task?

- Have you ever interacted with categorization of comments before? Using what system / software? If yes, then how was the experience? If no, then how was experience with it during the task?
- What did you think about the anchors inside the seek-bar of the video? Did it create any distraction?
- Did the different coloring of comments help you to find appropriate comments?
- What is your impression about the content highlighting?
- Do you think content highlighting will help users make other people understand what problems they are having?
- What improvement could be made to the systems?