

Digital Photos as Conversational Anchors

Ryan Y. Sit, James D. Hollan, William G. Griswold

University of California, San Diego

rsit@cs.ucsd.edu, hollan@cogsci.ucsd.edu, wgg@cs.ucsd.edu

Abstract

During shared viewing printed photos frequently serve as anchors for conversations. Conversational interactions are less common when images are not printed. People do not commonly gather around a monitor to look at digital images, although the passing around of cell phones and digital cameras displaying images is increasingly common. The congeniality of paper has many advantages for synchronous sharing. Although both printed and digital images can be shared asynchronously, the effort required frequently precludes such sharing.

JussPress (www.jusspress.com) is a system designed to minimize the effort involved in sharing digital photos. It enables instant publishing and organization. Automatic temporal organization of the photos is shown to have many advantages. Additionally, by making comments easy to make, read, and check, web-based photos also became anchors for conversations. We discuss the coherence of these conversations, instances of them spanning multiple photos, their organizational impact, and why conversations were infrequent for some users.

1. Introduction

Having conversations centered around photos is an important social component of photography. Conversations bring out meaning, strengthen relationships, and give joy, thereby adding value to photos. Conversational interaction may revolve around telling stories [3], reminiscing [4], asking questions, giving descriptions, having reactions, or making remarks on photos. These forms of interaction are well supported with printed photographs in communal spaces, such as gatherings around the kitchen table or on the living room sofa. In contrast, this naturalness of interaction has not been duplicated with digitally formatted photos published on-line [4]. Talk centered around on-line digital photos is infrequent, sparse, and commonly unidirectional, lacking the richness and naturalness of conversational interactions around printed photos. Given the growing movement to digital photography (e.g., digital camera sales have grown from 15 million in 2000 to 41 million in 2003) and digital storage of photo collections, understanding how to support conversational interactions centered around on-line digital images is of considerable importance for maintaining a key component of the social value of photos.

Interest in sharing digital photos is further highlighted by the recent availability and growing popularity of camera phones. With camera phones people can send digital photos instantly to friends' phones or post them on-line in a practice called "moblogging". A number of commercial moblogging websites have rapidly grown in popularity (e.g., Textamerica.com and Buzznet.com). Although, a recent study [1] shows the median user takes eight photos during the first week of their moblog, the number drops to one photo a week within a month and a median of zero photos after five weeks. The study goes on to recommend better incentives for posting content. One incentive may be the ability of the photos to generate conversational interactions. Frohlich et al. pointed out that "feedback from the audience appeared to play a significant role in people's motivation to put new material onto the web" [4]. Also, they found that "families experience as much joy from the feedback and subsequent conversation around the photos they have sent, as they do from sending or receiving the photos themselves".

Although digital cameras and camera phones are replacing film cameras, people still commonly rely on costly printing if they want to jointly interact with others around images. While face-to-face interaction is still preferred, our increasingly mobile society results in friends and family being widely dispersed. By revealing and then exploiting the distinctive strengths of on-line digital photo sharing while satisfying the communication needs of users, new opportunities for conversational interaction can be exposed [7]. To explore these opportunities an experimental web-based photo sharing system, named JussPress, was developed and studied over a two year period. A primary goal of JussPress is to improve support for interaction between photographers and visitors, hopefully allowing commenting to evolve into conversation. By resolving deficiencies related to comment making, reading, and checking, web-based photos became anchors for conversations on JussPress.

The following section summarizes related work on interaction around digital photos. Section 3 details the overall JussPress system to provide background for an examination of conversations on JussPress in section 4. The final section summarizes of our findings and suggests possible directions for future work.

2. Related Work

There has been little research on digital photo sharing and interaction. The available work can be characterized as focusing either on asynchronous or synchronous photo interaction. Asynchronous on-line interaction occurs at different times and often in different locations, for example on message boards, newsgroups, or email. Synchronous sharing involves people gathering at the same time either at the same place or different places, online chat and instant messaging are examples. Here we summarize representative current work.

Liechti [8] points out several notable limitations of current computer-mediated communication technologies: the large effort involved in thoughtful email exchanges or lengthy on-line conversation, how web pages provide only a one-way link from publishers to visitors, and the problems resulting from text-only interaction. He argues that these problems lead to lower quality and more infrequent interaction. As a solution, he discusses the need for improved “affective awareness” in order to provide a general sense of being in touch with one’s family and friends. Such feelings can be achieved through simple shared emotional experiences such as watching a movie, eating together, or playing a game. Liechti notes that this type of interaction is characterized by low effort interaction and argues that increasing affective awareness would minimize many problems found with current computer-mediated communication technologies. Based on this analysis, Liechti designed a system for asynchronously sharing digital home photography. The implementation focused on providing effortless photograph distribution, supporting passive viewing interfaces (e.g., using digital picture frames), and capturing viewers’ feedback from watchers automatically. Unlike JussPress, the system did not focus on supporting conversations.

There is also work on improving synchronous digital photo sharing. One example is a portable digital photo viewer [2] designed to enable digital photos to be used in a manner similar to printed photos. The device mimics traditional photo albums with the added facility to record stories. PicShare [11] developed by HP Labs is another synchronous sharing application. It is based on results from a requirements study [4] and attempts to recreate the feeling of face-to-face conversations when sharing printed photos. PicShare allows people to exchange, browse, point at, and talk about digital photos remotely with friends and family. Although conversations can be conducted with both applications, synchronous sharing requires an arranged time commitment and meeting coordination that can limit the frequency of such interactions. One motivation for JussPress is to greatly reduce the difficulties associated with sharing digital photos.

3. JussPress

The design of JussPress was partially inspired by Factoid’s [9] vision of easily journaling one’s daily life. The project is based on the idea of wirelessly transferring photos and instantly publishing them on the web. The name “JussPress” derives from our motivation to provide a “single press” design. With one press of a camera button a photograph is captured, wirelessly transferred, edited into thumbnails, automatically organized, and then instantly published. The need for a desktop computer can thus be abstracted away and sharing is streamlined.

Support for interaction between photographers and visitors is provided by photo comments. Comments are formatted like instant messages and require no registration or login. A unique summarization method allows users to easily read new comments and carry on conversations around and across photos. The system also notifies photographers of new comments made on their photos through instant messaging clients.

To upload photos to the website two methods have been explored: a wireless camera prototype, designed to provide facilities we expect to be common in future digital cameras, and a desktop drag-and-drop upload application. The wireless camera uses WiFi (802.11b) for wireless transport and ActiveCampus [5] technology to attach geo-location information to photos. The wireless camera provides the single press functionality that inspired the design of JussPress, but now that camera phones are prevalent, we have retired the prototype and are in the process of adding an email-uploading component to support camera phones. The desktop application allows people to use standard digital cameras to publish photos on JussPress. The desktop application increased the user base and thus allowed more extensive testing of JussPress’ facilities. Current users employ the desktop drag-and-drop application, depicted in Figure 1, to upload photos to JussPress. All photos are resized to around 40 KB before transfer and therefore even hundreds of photos can be uploaded quickly.

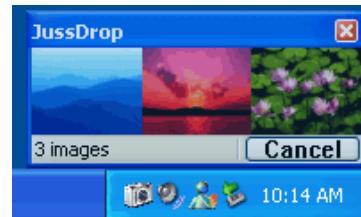


Figure 1. Drag-and-Drop Uploading Application

After photos are uploaded they are available on-line at www.jusspress.com. Figure 2 depicts the flow of browsing interaction on the website. From the homepage users may register as new users, look up users in the directory, or choose from a list of users with new photos,



Figure 2. Website Layout and Basic Browsing Flow

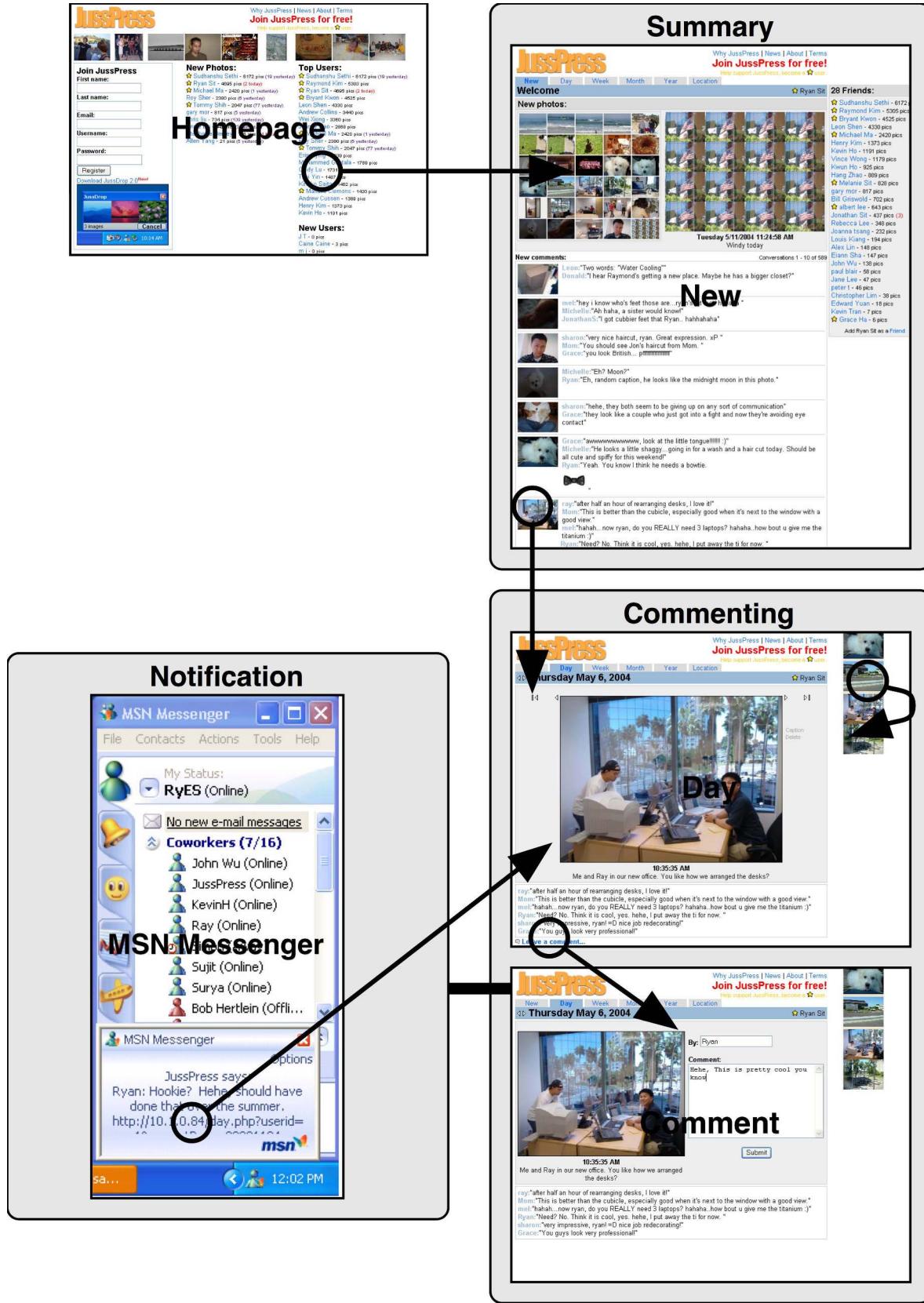


Figure 3. Flow of Commenting on JussPress

most active users, or newly registered users. Once a user account is clicked on, the visitor is taken to the “New” page that summarizes the newest photos and comments, and lists the accounts of the user’s friends. From this page users may look through new content, or browse through old photos organized either by calendar days or by location. Along the top are tabs that link to the New, Day, Week, Month, Year, and Location pages. Using the tabs a user can jump to any view. The photographer may choose to caption or delete a photo from the Day view. The arrows in Figure 2 show the normal flow when navigating through views.

Figure 3 shows the flow of commenting on JussPress. Commenting is triggered either through the comment summary, when browsing photos, or by a comment notification. From the bottom of the Day view a user may click to the commenting page. There the commenter enters their name and comment, and then submits the form. When the server processes the form it also sends an instant message to the photographer. The photographer will receive the notification if he is on-line and may click the link to the photo to make a reply.

3.1. Users

At last count the JussPress database included over 350 registered users and web server logs showed thousands of unique visitors per month. We counted a roughly equal amount of registered male and female users, split 55/45 respectively. The age of users varies, but we estimate that the primary activity is from 16 to 28 year olds. Users mainly include high school students, college students, and young adults. JussPress users appear to be similar in composition to regular users of instant messaging. Hence they enjoy keeping in touch with friends and family on-line and are familiar with computer-mediated communication technologies. There were 30 registered users after JussPress’ first year of development. About half of these users still regularly use JussPress. After 2 years there were 150 registered and in the following months the count reached 350. Of the users that have posted photos, 11% have over a thousand photos, and 48% have hundreds of photos.

JussPress is composed of a number of separate communities. Friends bring in their own separate groups of friends. The activity of registered users is dependent on them creating or joining a community and the activity of their community as a whole. Users who fail to associate with a community often stop using JussPress.

3.2. Photos

When the situation of how photos are taken, viewed, or shared is drastically changed, the way photography is used can also change. A major change was shown in [10] and similarly the types of photos on JussPress are very different from printed photos. Printed photos are

normally of smiling faces, scenic landscapes, or family portraits. Photos on JussPress are more journalistic, more disposable, more spontaneous, and more numerous. One user posted photos showing where they found a scorpion, how they caught it, their reactions, and the final outcome. Others introduce new spaces by taking photos of their surroundings. Some photos are taken to provoke reactions, some to ask questions, some as a visual record for future reference. Photos of outfits or wedding cakes are used to elicit opinions from friends. Often users take photos of themselves to publish their current mood or expression. The most popular types of photos are of food. Common to all photos posted on JussPress is the purpose to share and elicit feedback. Few photos are posted that do not seem to imply a desire for feedback.

4. Conversations on JussPress

The section begins with the design rationale for encouraging conversation, followed by a description of the components that support conversations, and concludes with a discussion of the effectiveness the design.

4.1. Design Rationale

The design was influenced by Liechti’s work on affective awareness [8]. Affective awareness is a general sense of being close to one’s family and friends. Liechti created an affective link between photographers and watchers in two directions, supported by implicit interaction. Although Liechti focused on the importance of implicit affective awareness, from his work we interpreted a more general need for explicit feedback. Feedback completes a loop that provides stimulation in a cyclic manner. This stimulation acts as positive reinforcement. Effectively a two-way reward system is created in which photographers are rewarded by comments, and people who comment are rewarded by more photos or a reply. Each side is effectively rewarded by the other (Figure 4). Following from this rational it becomes paramount that the cyclic flow of interaction between photographer and visitors be optimized to encourage interaction as a whole.

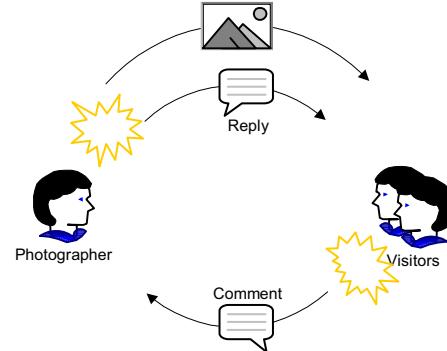


Figure 4. Interaction on JussPress

4.2. Components

Commenting on JussPress involves three components: the basic layout, the summary, and notifications.

To encourage people to comment no registration is required. To minimize the perceived effort to enter a comment only two fields are presented: one for the name of the writer and another for the comment. To encourage continuing exchanges, comments are formatted like conversations on instant messengers. The layout is devoid of dates, times, and separations between postings. The resulting layout is shown in the "Commenting" block in Figure 3.

Based on experience with this basic layout, it became apparent that comments were scattered through separate photos and were hard to track and read. To solve this problem a summary of new comments was designed. At first new comments were individually featured alongside a thumbnail of the photo, but this limited the available context of comments in the summary and created a very sparse looking summary. An important change was to display all comments for a photo together with the new comment. When a new comment is made on a photo the entire group of comments or complete conversation is promoted to the top of the summary. The summary of new comments is displayed in the bottom part of the New page as seen in Figure 3 in the "Summary" block.

Once new comments were summarized on the main page we noticed that photographers began repeatedly checking for new comments throughout their day. Many photographers found reading new comments enjoyable, but continually checking for new comments was bothersome. To alleviate this problem a notification system that pushed new comments to photographers was designed. MSN Messenger is used to deliver notifications because of its available API and complementary notification features. When the server receives a new comment a process is called that sends an instant message to the photographer. On the photographer's computer a momentary dialog slides up to display the writer, new comment, and a link to the photo. An example of a notification can be seen in Figure 3 at the bottom of the "Notification" block.

Improving commenting has resulted in a system that helps sustain conversations around on-line digital photos published on-line. It also revealed new usage patterns. We turn now to a discussion of these new patterns.

4.3. Results

After two years of research and development JussPress has amassed a community of hundreds of users. Rather than presenting data from structured evaluations of arranged usage or of short-term limited field studies, JussPress' large user community allows us to present everyday usage patterns from two years of

deployment. Our focus is on understanding how and why the system is used to support conversations. We employ both qualitative and quantitative data. Our goals are to characterize interesting behaviors that happened regularly, understand how and why they happened, and employ these usage patterns and understandings of them to improve JussPress and better support sharing of digital photos as well as their ability to serve as conversational anchors.

Usage was studied through data culled from a number of sources. The system database stores records of registered users, uploaded photos, and photo captions and comments. Web server logs show traffic to different interfaces and user accounts, and times of usage. A short formal user study provided data from questionnaires and interviews.

The most useful data came from prolonged observations and experience with the system and its users. Daily experience with the system revealed reactions to system changes. Regular informal conversations with personally known users exposed feelings towards features and reasoning for use. This data provided insights into how and why JussPress is used.

4.3.1. Comments as conversations. The effectiveness of supporting conversations can be studied by looking at actual conversations sustained on JussPress. The following is a typical example:



we have seven segways to use and abuse (only three shown here. the rest are being charged up). i'm trying to set up a jousting match before i leave ray: "do they run on sand?"

wendy: "supposedly they do. but our boss doesnt allow that cuz he's afraid the sand would leak in and mess up the machine. they're supposed to run in water too, but i havent tried it."

wendy: "i take it back, it wont run on sand cuz there's no traction. it doesnt even do well on semi sandy ground."

Leon: "Nice Segways. Do they live up to the hype? They kinda fun."

wendy: "they're definitely fun to ride and play with for a while. but for \$5000, there's better things to buy."

Leon: "Hmm... Like a nice, used YZF-R6. *drool* =)"

Bryant: "How much does it cost to rent one of those Segways? BTW: Just noticed leon's comment at the end here.. haha.. I didn't know he was thinking about an R6 for SOOO long. ;p I guess it's good that he finally got one. ^_^"

Bryant: "Oh.. if you guys ever have any used Segways for sale.. I think they'd make really cool pit lane transportation at my races next year. heheh. ;p"

wendy: "I dont work there anymore, but I believe its \$400/day, \$250 for half day. If you're interested, I can give you my boss's number. Maybe if you mention that I referred you, you can haggle a better price. =D"

Figure 5: Photo as Conversational Anchor

Wendy is the photographer in the above conversation. All the comments were around the single

photo. Comments came from friends that Wendy knew in person. In this case all comments came from registered users of JussPress. The conversation includes 9 comments between 4 different people. There appears to be 3 exchanges made up of 3 comments each. Each exchange is between a visitor and the photographer. It can be seen that each additional comment builds upon previous comments. Comments are interrelated rather than independent. For instance, the first apparent exchange starts with Ray asking a question followed by an answer by the photographer and then a repair of her answer. Later Leon asks a question. Wendy responds with an opinion and Leon gives a response to the opinion. In the last exchange, Bryant asks a question and also makes a remark in reference to the prior exchange. Bryant then adds another remark that he appears to have thought of after the first comment. Lastly, Wendy responds with an answer and tip.

Figure 6 is an example of another conversion on JussPress. The conversation shows an exchange of opinions and thoughts on the subject of ant extermination. A person wrote about his own experience, another then offered her own solution, one more gave his own thought on the problem, and another person gave a final suggestion. It has a feeling of a meaningful group conversation between friends.



Well I haven't posted anything interesting in a while. Haven't been doing much. We did have an exterminator come by this morning. Took care of all the ants.

Leon: "My exterminator told me to expect ants for two more weeks. It's been two weeks and I still have ants. >=("

Ryan: "Dude I just watched the guy and figured out what they do. They don't do anything special. Western Exterm just uses "Suspend" all along the perimeter of the house. Check out www.doyourownpestcontrol.com. They recommend a bait and spray combination. You can do it yourself. I think I will just do that now instead of paying some dude. Besides it feel good killing your own ants."

Michelle: "I think we should go find the nest...the exterminator didn't even look for it."

Leon: "Yeah, Joe recommended this thing you attach to your garden hose and then spray your whole yard."

ray: "Sorry, Michelle, but San Diego was built on top of an ant hill. Everyone has ants during this time of year."

Mom: "Dad suggests you buy Marathon from any hardware store and spray along the perimeter of the house and the yard. It will kill most of them and also mosquito and flies too. If the ant is inside the house, then buy those termite control liquid to spray along the perimeter and also the air holes of the foundation. This is more toxic and more expensive, so don't use for the yard."

Mom: "If you have paid, you are guaranteed the result. So, call them back to do it again until the situation is under control."

Figure 6: Photo as Conversational Anchor

Although it is not unusual for conversations to be of this length on JussPress, often people do not talk this

much about a single photo. Rather a majority of photos have only 1 comment. Considering all the photos with comments, 41% have 2 or more comments. A majority of conversations on JussPress are simple exchanges consisting of 2 or 3 turns. It is more important to note that JussPress has the ability to sustain longer conversations, and to understand how and why conversations occur.

Conversation on JussPress can be best understood by studying the coherence of the photo comments. Coherency is an important property since it is the "glue" that connects comments into conversations. The long conversation in Figure 5 is an example of a coherent conversation. The conversation is made of up 3 separate exchanges with low disruption or intervention. Hence adjacent turns have high relevance. Plus there is low spatial distance between turns. Therefore it is easy to identify messages with their responses. Many other conversations on JussPress have this same conversational coherency. To enable coherent conversations around digital photos three interactional coherence problems are addressed by JussPress: turn adjacency, overlapping exchanges, and topic decay.

Turn adjacency refers to related turns being close to each other both spatially and temporally. Less spatial distance improves the correlation of messages with their responses. By formatting consecutive comments on JussPress with no spaces and no major textual divisions (time, date, email, webpage) a discernible type of talk occurs. Comments forcibly appear related because of their close proximity, thereby inducing an interchange of comments. In contrast commenting systems with gaps decrease the perceptual interrelation and predominantly produce disjoint posts that do not anticipate a reply. Secondly, decreasing temporal separation improves the continuance of a conversation. Without a timely response the conversation decays and the desire to initiate future conversations may fade due to the feeling of being disregarded. Comment notifications on JussPress help decrease temporal separation. Photographers are notified of new comments immediately and tend to respond, if they do, promptly. As a result photographers with comment notifications often have longer conversations and a larger number of exchanges. Turn adjacency can also be improved by decreasing overlap.

Overlap occurs when separate exchanges are interwoven. Overlap interrupts conversations and makes them more difficult to follow and continue. Overlap is less likely on JussPress for two reasons. First, sharing photos on-line with JussPress supports what may be called a topical divide-and-conquer scheme. On JussPress a single photo anchors an exchange, plus talk is normally between a photographer and his/her limited set of friends. By breaking up the potential talk into separated topic chunks with limited

participants, the possibility for incoherent talk is reduced and there is less chance for conversations to diverge into separate topics. It is more likely for talk to be separated through different photos, with fewer people available to interrupt talk. Any overlap that does occur is easily discernable. Second, comment notifications decrease overlap in addition to helping temporal adjacency. Improving temporal adjacency, particularly in asynchronous communication, greatly decreases overlap since considerable time lags (from hours to days) are normal between asynchronous messages. By promoting a quick response within a minute or two, it is very unlikely any asynchronous message will intervene. Note though that comment notifications are only a partial remedy since they only notify the photographer and not visitors. It is possible for overlap to occur from other visitors after a photographer's response, but this is not common for a number of reasons. The visitor may still be browsing when the response is given and may see the response before leaving. Exchanges are predominately only 2 to 3 messages in length. Plus only one visitor may be interested in talking about the photo.

Topic decay is another critical problem for coherent conversations. Topic decay occurs when talk becomes old and distant. Aging topics become harder to refer to, and the topic increasingly must compete with new discussions. Topic decay is common in face-to-face conversations where old topics take time to refer back to and new participants cannot easily join in. Similar situations occur in on-line synchronous chat channels and on-line asynchronous Internet discussion boards [6].

Problems with topic decay have not been evident on JussPress. This is partly due to the aforementioned breakup of talk but mostly a result of JussPress' comment summarization method. By breaking up talk into separate threads and limiting the thread to one photo, talk can easily be referred back to. When talk is in referable blocks the problem becomes how to refer to them. The comment summarizations on JussPress ease reference by promoting an entire block of conversation whenever a new comment is posted. In essence, any new talk makes the entire conversation the newest topic. Even year old conversations can become the latest talk if only one new comment is added. Every time talk continues, the conversation jumps back up to the top. The conversation slowly decays down the list as talk ends and new conversations around other photos occur. Still the decaying conversation can quickly be revived at anytime.

Improvements in turn adjacency, exchange overlap, and topic decay, increases conversational coherency. When coherent conversations can be carried on, more productive interactions can happen and therefore more enjoyment from on-line photo sharing may result.

4.3.2. Conversations held across multiple photos. An interesting occurrence on JussPress is conversations

held across multiple photos. Figure 7 shows one such conversation, although without the correlating photos to save space. The conversation is around selecting a wedding cake and so the missing photos are simply of different cakes. Each bunch of comments is attached to a single cake photo. Figure 7 shows the comment summary for one user's photos during the time of the conversation. Comments were all from friends that the user knew in person. Some are registered JussPress users that also upload photos and some are just visitors.

Ryan: "this one..."

Michelle: "Yeah, for me it is between this one and the one with the little pink flowers."

sarah: "this is my #1 choice...very elegant."

Sandy: "I like this one too"

Grace: "I think this one matches the best with the colors and stuff... are those pearls on the cake??! That looks so cool!"

Linda: "Yep, I like this one the best out of the others too =)"

Bryant: "Hi Ryan.. I like this one! Yummy! I mean.. very elegant, clean, not to busy with decorative pieces... This is one *CHOICE* cake. ^_^"

Sharon: "this one is gorgeous."

Ryan: "Ya, I think JussPress has spoken with all the good feedback on this cake. We will probably get something like this."

ray: "Just make sure there's ice cream inside. =P"

Linda: "This one is nice if you can eat the leaves =D"

Sharon: "this one is very pretty too"

Michelle: "I like this one, it's so clean and neat."

Ryan: "Ya, but I dunno how it would look for a wedding cake. Too simple."

sharon: "i think this one is very clean too. Albert said that it's a good color scheme and very elegant."

Sandy: "this looks like the chiquita banana lady's hat."

sharon: "Albert said that too, sandy, this one is a bit strange."

Sandy: "I like this one"

Grace: "I like the other one better... but this one looks really elegant too"

Linda: "The actual cake looks too plain. if they added some sort of design on the white parts...."

sharon: "i like this one too. "

Ryan: "I like this one..."

mel: "yeah i like this one too"

Bryant: "Hmm.. this one I like too actually. Not quite as much as the other one though.. "

Thai: "This one is nice if you want to go for that high class frills look."

Michelle: "A little too much foof for me."

Ryan: "That is what I was thinking. They are cool and all, but a bit toooo fancy."

ray: "Is that eatable?"

Michelle: "Ray, you're so funny!"

Sandy: "What the...?"

Linda: "Metal cake?"

Ryan: "...and this one."

Michelle: "I like this one too!"

Linda: "It looks... uneven... "

ray: "For some reason, this reminds of the movie "Godfather""

sarah: "very summer-y looking...i like it!"

Figure 7: Conversation across Multiple Photos

The coherency of the conversation across photos is based on the same principles of adjacency and overlap discussed earlier. In this case it is the comment summary that facilitates high adjacency and low overlap. The comment summary looked very much like Figure 7 during the time of the conversation. Since wedding cakes were the hot topic for the day, all the talk spread across cake photos was clustered together in the summary due to the timing of the comments. This allowed visitors to quickly scan through all the talk and jump in with their own input. Low overlap was sustained until talk was exhausted and fresh photos were posted. The photographer has some control over overlap in the summary since he controls when new photos, or in other words potential topics, are introduced. In the end, the cake that had the most talk happened to be the one chosen for the wedding.

One problem that isn't fully solved with JussPress' current feature set is topic decay on conversations held across photos. There is currently no way to bring back the complete conversation around cake photos. Even so, it may be possible with additional features and currently does not appear to be a major issue.

4.3.3. Conversations as an organization method. An interesting realization is how conversations around photos can be leveraged for photo organization. Currently, the comment summary tends to organize the most interesting recent photos on the front page. When a photographer uploads many new photos, or when a visitor has not visited in a while, the organization of photos in the comment summary can be used to quickly skim through the most recently discussed events. Furthermore conversations can also potentially bring out the best quality photo. When there is a large group of similar photos visitors are likely to choose the best photo to comment on.

Future work could more explicitly leverage conversations for organization. For instance, the length of a conversation on a photo could aid organization. A longer conversation shows a higher interest in a photo in relation to neighboring photos. This can equate to a higher rank. The ability to accurately rank photos can be leveraged in a number of ways to improve organization. For example, in textual searches of comments and captions a rank could be used to order the results. Also, when summarizing large groups of photos ranking can be used to bring out the more memorable photos. It may be easier to recall related photos from one memorable photo.

4.3.4. Failures to Converse. Conversations on JussPress are triggered by various events such as commenting on a "cute" photo, questions posed by a visitor or the photographer, or an interesting event or achievement shared through JussPress. These

conversation triggers parallel those typical with printed photos. Of greater interest is why some active user accounts *do not* generate conversations. User accounts with few conversations usually have one or a combination of the following qualities. The most common proximal cause is the failure of photographers to reply to a comment in a timely manner. The consequence is that the visitor may feel disregarded and is thus unlikely to make additional comments. Due to the conversational layout of comments on JussPress, the result is as if someone sent an instant message to a friend and never got a response. Additionally, we conjecture that when visitors see that a photographer does not normally reply to comments they will be less likely to comment themselves.

Another factor that may influence the likelihood of conversations is when a photographer uploads too many thoughtless photos. Since users are listed by the number of photos they have, some users purposely take a larger number of photos in order to be listed higher. These users often post many copies of similar shots, or post many photos of mundane activities. We found that visitors to these user accounts either get tired of browsing the overabundance of photos and stop visiting or, due to the volume, just browse through the photos quickly without stopping to comment. In either case, it is apparent that conversations are not common on accounts with large numbers of thoughtless photos.

Similarly, when photographers do not frequently post new photos but rather post large collections in spurts each month or every few months, few conversations result. If photos are not regularly published, then visitors do not regularly visit the poster's collection and the photos when published are less current. Visitors may need to be re-invited each time new photos are posted. In addition, photographers who only occasionally post photos, typically only occasionally visits their website, so visitors are unlikely to receive timely responses to comments. Comment notifications can help elicit responses, but at this time not all photographers have notifications enabled. We observed that users who regularly post new photos on the day they are taken or regularly each week start to accumulate a returning base of visitors. User accounts with this type of behavior visibly show an improvement in the frequency and number of conversations.

Finally, some user accounts do not have many conversations because the photographer does not invite many friends to the site. These users may be using JussPress primarily to assist in organizing their photos. Occasionally a random JussPress visitor may comment on one of their photos, but normally in these cases the comment does not turn into a conversation, perhaps because the photographer does not personally know the visitor.

5. Conclusion

JussPress allows on-line digital photos to function as conversational anchors. By recognizing the need to optimize the cyclic flow of interaction between photographers and visitors, three components were developed: a basic layout for commenting, the comment summary, and comment notifications. Usage of these components has produced conversations around individual photos and across multiple photos. Conversations are facilitated by features that support coherent talk around photos. JussPress enables coherent conversations by providing high turn adjacency, low overlapping exchanges, and revivable topic decay. We also discuss the potential for photo conversations to help with organization and why conversations were less frequent for some users.

JussPress provides an effective foundation for exploring on-line conversational interaction centered around photos. The JussPress user community continues to grow and provide research opportunities to investigate other aspects of on-line conversations. For example, one potential future direction is to support conversations around photos posted elsewhere on-line. A number of JussPress users maintain on-line journals (blogs). Since photos are often included in blogs, it would be interesting to allow conversations around those photos without necessitating visits to JussPress itself. The underlying notion is to integrate conversations that are natural components of users' diverse on-line activities and allow us to explore extending JussPress commenting features to these activities.

Real-time conversational activities would also be interesting to investigate. On JussPress photographers can reply in real-time to comments after getting a notification, but real-time conversation in both directions is not currently supported. Real-time replies are only a side-effect of notifications. In cases when both parties want to have a synchronous conversation, this could be supported via a custom instant messenger client on the photographer's computer. The photographer could activate the client if he is interested in chatting with visitors. The website would make this activation visible by providing the option for visitors to comment or chat. This chat option would only be available if the photographer's client is enabled.

Another area of interest is supporting alternative ways to interact around photos on-line. One way is to provide facilities for users to draw on photos. In this way certain parts of a photo can be highlighted, allowing users to communicate graphically as well as textually around photos. Deictic reference is a key component of interaction with printed photos. Similarly, other features of face-to-face interaction could be supported. For example, audio comments could be captured. Audio would allow more expressive

communication. It would be quite interesting to see differences between conversations involving audio and those conducted purely textually.

6. References

- [1] Adar, E. (2004). Usage Patterns for Cameraphone Driven Moblogs. Hewlett-Packard Labs Information Dynamics Group.
- [2] Balabanovi, M., Chu, L. L., & Wolff, G. J. (2000). Storytelling with digital photographs. The 2000 ACM Conference on Human Factors in Computing Systems (CHI'00), pg. 564-571.
- [3] Chalfen, R. (1987). Snapshot versions of life. Ohio: Bowling Green State University Press.
- [4] Frohlich, D., Kuchinsky, A., Pering, C., Don, A., & Ariss, S. (2002). Requirements for photoware. Proceedings of CSCW 2002, 166-175.
- [5] Griswold, W. G., Boyer, R., Brown, S. W., Truong, T. M., Bhasker, E. Jay, G. R., & Shapiro, R. B. (2002). ActiveCampus – Sustaining educational communities through mobile technology. Technical Report CS2002-0714, University of California, San Diego, Department of Computer Science and Engineering.
- [6] Herring, S. C. (1999). Interactional Coherence in CMC. Journal of Computer-Mediated Communication, Volume 4, Number 4.
- [7] Hollan, J., Stornetta, S. (1992). Beyond Being There. The 1992 ACM Conference on Computer Human Interaction (CHI'92), pg. 119-125.
- [8] Leichti, O., & Ichikawa, T. (2000). A digital photography framework enabling affective awareness in home communication. Personal Technologies, 4 (No.1), 6-24.
- [9] Mayo, R. N. (2001). Reprint of the factoid web page. Technical Note TN-60, Compaq Western Research Laboratory
- [10] Mäkelä, A., Giller, V., Tscheligi, M., & Sefelin, R. (2000). Joking, storytelling, artsharing, expressing affection: A field trial of how children and their social network communicate with digital images in leisure time. The 2000 ACM Conference on Human Factors in Computing Systems (CHI'00), pg. 548-555.
- [11] PicShare [Computer Software]. (2002). Bristol, UK: Hewlett-Packard Labs.