

Evaluation on Personal Information Management Processes

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Abstract: This study considers Personal Information Management (PIM) processes for system design and development. Keeping, managing, maintaining and re-finding are the main processes in PIM. A control lab based-user evaluation was conducted to compare our proposed system (photo refinder) against baseline system. User's opinions and time taken to complete each process were used as criteria for efficiency. Findings revealed that photo refinder makes keeping and managing processes interesting, maintaining process satisfying and interesting and re-finding process easy, relaxing, simple, satisfying and interesting. Findings also showed that, users took significantly longer time to complete keeping and managing processes using photo refinder compared to the baseline system, meanwhile, they took significantly less time to complete re-finding task using photo refinder compared to the baseline system. The results suggest that, supporting PIM processes including the introduced features (delete in keeping process, tag and annotation in managing process, track all the changes in maintaining process, search and browse in re-finding process) are potentially efficient for improving personal photographs management in general and re-finding in particular.

Key words: Personal information management, PIM processes, photo refinder, evaluation, particular, system

INTRODUCTION

Personal Information Management (PIM) has become an important topic in the information retrieval area in which it is playing an interesting role in keeping, managing, maintaining and re-finding personal information (Al-Nasar *et al.*, 2014). In the era of complex information and variety of data types, it is evident that people may need to use PIM systems to organize and retrieve information to carry out their personal or professional tasks (Whittaker, 2011; Al-Nasar *et al.*, 2014). Therefore, PIM has a lot of significance in day to day lives. It is vital for people to find and extract their collections efficiently in a specific time (Kirk *et al.*, 2006; Whittaker, 2011). However, it was clear that there is a lack of assessment in supporting PIM processes in previous systems (Whittaker, 2011). The challenge is to provide systems that accommodate PIM processes. The features introduced in previous systems (Cohen, 2005; Kang *et al.*, 2007; Kang and Shneiderman, 2000; Mota *et al.*, 2008; Cohen and Itoh, 2011) did not support all PIM processes. However, not many studies have been conducted in the field of photographs re-finding so far. Most of studies focus on content based retrieval rather than PIM processes (Whittaker, 2011). They focused more on their design about algorithms either fully automatic (Sinha and Jain 2008, Cho *et al.*, 2013; Rodden and

Wood, 2003) or semiautomatic (Mota *et al.*, 2008) to help users to perform some activities such as tagging, annotation and classifications which is mainly used to support managing process or better retrieval.

Previous researches have suggested that photograph management systems with PIM processes should be supported. Kirk *et al.* (2006) have showed that deleting unwanted, irrelevant or blurred photographs could enhance the process of re-find. Annotation and tagging during managing process could enhance the re-finding process (Cohen, 2005; Hearst, 2009; Whittaker, 2011). Teevan (2004) has shown that, the desktop environment could be very dynamic. It was common that the photographs which were moved become difficult to be re-found (Whittaker *et al.*, 2010). Therefore, tracking all the changes that happened to information is useful to facilitate re-finding process. Finally, combining both searching and browsing is an important approach to help users to re-find their targeted information faster (Hearst, 2006, 2009). These suggestions were later used to design photo refinder system.

MATERIALS AND METHODS

User experiment: The photo refinder system is evaluated against baseline system. The baseline system tries to simulate the real tasks that people do in their daily lives

once they want to keep and manage their photographs in the operating system. Retrieving the photographs is performed by browsing the album collections, changing the album view size option, sorting the albums based on (date, name) changing the thumbnails view size option and sorting the thumbnails based on (date, name). Meanwhile, the photo refinder is enhancing each and every process of baseline system by introducing delete in keeping process, tag and annotation in managing process, track all the changes in maintaining process, search and browse in re-finding process.

Users were given four tasks (keeping, managing, maintaining and re-finding the photographs) in a control lab based-user evaluation. Both systems are designed to simulate the real tasks that people do in their daily lives in dealing with personal photographs. About 20 users (10 undergraduates and 10 postgraduates) were involved to perform all PIM processes in this experiment.

For experimental data, all participants were asked to bring their own collections to the lab. The number of photographs collections was controlled during the experiment to avoid bias. Therefore, 10 participants brought more than 1000 photographs and other 10 participants brought <1000 photographs. The amount of photographs that used in this experiment was sufficient to give an indicator about the time and effort needed to perform PIM processes.

Participants had a chance to perform the tasks using both systems in a training session to familiarize themselves with the systems and the experiment's tasks. During the evaluation, participants have been given four main tasks based on the PIM processes (keeping, managing, maintaining and re-finding). Among these tasks, participants kept and managed the photographs continually. Maintaining and re-finding tasks were performed in the evaluation after all participants had kept and managed their collections in both systems. These tasks were divided into three main sessions where participants performed keeping and managing in session one, maintaining tasks in session two and re-finding tasks in session three. Participants were offered a short break (5-10 min) after each session. In sessions two and three, the tasks and systems were assigned according to a Greco-Latin square design (Jones, 1981). In the maintaining task each participant performed two moving and two updating tasks in each system. In the re-finding task each participant performed five tasks. The tasks and the systems were rotated to minimize possible learning effects.

After completion of each task, participants completed a questionnaire about the system they just used. There were five different questions to measure user's opinions

(easy, relaxing, simple, satisfying and interesting) as Likert scale from 1-5 (the higher the better). The time taken to complete each task in each session was captured in userlog. Finally, an exit questionnaire was given to the participants by the end of the evaluation.

RESULTS AND DISCUSSION

Participant's performance was analyzed to measure the efficiency of photo refinder and the baseline systems in performing the PIM processes. Participants performed 200 tasks, 20 (10%) of these tasks were keeping and managing 80 (40%) were maintaining tasks while the remaining 100 (50%) tasks were re-finding. Post-task questionnaire, exist questionnaire and userlog analysis were contacted to capture data. Both systems (photo refinder and baseline) that participants perceived as easy, relaxing, simple, satisfying and interesting during all giving tasks were examined as shown in Table 1-4.

Keeping task

Easy: In Table 1, a ratio of 17 participants to 1 found that, the baseline system was easy to use (Mean = 4.45, SD = 0.887) compared to photo refinder where the ratio of 5 participants to 1 found that photo refinder was easy to use (Mean = 4.20, SD = 0.894). However, participants felt that both systems are easy to use to complete the keeping tasks. There was no statistical significance difference in user's opinions (Easy) across systems (Wilcoxon signed-rank test, $p = 0.400$).

Relaxing: A ratio of 17 participants to 1 found that, the baseline system is relaxing to use (Mean = 4.10, SD = 0.788) compared to the photo refinder where the ratio of 16 participants to 1 found that photo refinder was relaxing to use (Mean = 4.20, SD = 0.768). However, there was no statistical significance difference in user's opinions (relaxing) across the systems (Wilcoxon signed-rank test $p = 0.593$). These results also supported the perceived ease of using both systems to perform the keeping task.

Simple: A ratio of 18 participants to 1 found that, the baseline system was simple to use (Mean = 4.10, SD = 0.912) compared to the photo refinder where the ratio of 5 participants to 1 found it simple to use (Mean = 4.05, SD = 0.887). There was no statistical significance difference in user's opinions (simple) across the systems (Wilcoxon signed-rank test, $p = 0.935$).

Satisfying: A ratio of 4 participants to 1 found that, the baseline system was satisfying to use (Mean = 3.70,

Table 1: Percentage of the user's opinions of the baseline system and photo refinder during the keeping task

User opinion System used	Scale (%)					Percentage		Ratio
	1	2	3	4	5	Negative	Positive	
Difficult Easy								
Baseline system	0	5	10	20	65	5	85	17:1
Photo refinder	0	15	10	30	45	15	75	5:1
Stressful Relaxing								
Baseline system	0	5	10	0	85	5	85	17:1
Photo refinder	0	5	15	40	40	5	80	16:1
Complex Simple								
Baseline system	0	5	5	35	55	5	90	18:1
Photo refinder	0	15	10	45	30	15	75	5:1
Frustrating Satisfying								
Baseline system	5	15	15	25	40	15	65	4:1
Photo refinder	0	5	15	45	35	5	80	16:1
Boring Interesting								
Baseline system	5	10	20	40	25	10	65	6:1
Photo refinder	0	5	15	45	35	5	80	16:1

Table 2: Percentage of the user's opinions of the Baseline system and photo refinder during the managing task

User opinion System used	Scale (%)					Percentage		Ratio
	1	2	3	4	5	Positive	Negative	
Difficult Easy								
Baseline system	5	10	15	30	40	15	70	5:1
Photo refinder	0	5	25	35	35	5	70	14:1
Stressful Relaxing								
Baseline system	0	20	15	0	65	20	65	3:1
Photo refinder	0	5	20	50	25	5	75	15:1
Complex Simple								
Baseline system	0	15	25	20	40	15	60	4:1
Photo refinder	0	5	25	35	35	5	70	14:1
Frustrating Satisfying								
Baseline system	15	10	30	15	30	25	45	2:1
Photo refinder	0	10	20	30	40	10	70	7:1
Boring Interesting								
Baseline system	10	15	30	25	20	25	45	2:1
Photo refinder	0	10	20	30	40	10	70	7:1

Table 3: Percentage of the user's opinions of the Baseline system and Photo refinder during the maintaining task

User opinion System used	Scale (%)					Percentage		Ratio
	1	2	3	4	5	Positive	Negative	
Difficult Easy								
Baseline system	5	10	15	30	40	15	70	5:1
Photo refinder	0	5	5	35	55	5	90	18:1
Stressful Relaxing								
Baseline system	5	0	20	0	75	5	75	15:1
Photo refinder	0	5	15	35	45	5	80	16:1
Complex Simple								
Baseline system	0	5	15	25	55	5	80	16:1
Photo refinder	0	5	10	45	40	5	85	17:1
Frustrating Satisfying								
Baseline system	5	15	15	40	25	20	65	3:1
Photo refinder	0	5	5	40	50	5	90	18:1
Boring Interesting								
Baseline system	10	10	35	20	25	20	45	2:1
Photo refinder	0	5	5	30	60	5	90	18:1

Negative = scale 1, 2; Positive = scale 4, 5 (scale from 1-5, higher = better; highest value shown in bold)

SD = 1.261) compared to photo refinder where the ratio of 16 participants to 1 found it satisfying to use (Mean = 4.15, SD = 0.745). Participants felt more satisfied when they performed keeping task with photo refinder. Again, there was no statistical significance difference in user's opinions (satisfying) across the systems (Wilcoxon signed-rank test, p = 0.185).

Interesting: A ratio of 6 participants to 1 found that, the baseline system was interesting to use (Mean = 3.50, SD = 1.051) compared to photo refinder where the ratio of 16 participants to 1 found it interesting to use (Mean = 4.15, SD = 0.813). There was a statistical significance difference in user's opinions (interesting) across systems (Wilcoxon signed-rank test, p = 0.049).

Table 4: Percentage of the user’s opinions of the Baseline system and photo refinder during the re-finding task

User opinion System used	Scale (%)					Percentage		Ratio
	1	2	3	4	5	Negative	Positive	
Difficult Easy								
Baseline system	15	25	30	10	20	40	30	1:1
Photo refinder	0	5	5	15	75	5	90	18:1
Stressful Relaxing								
Baseline system	10	50	15	0	25	60	25	0:1
Photo refinder	0	5	10	20	65	5	85	17:1
Complex Simple								
Baseline system	25	25	15	20	15	50	35	1:1
Photo refinder	0	5	10	0	85	5	85	17:1
Frustrating Satisfying								
Baseline system	35	25	15	15	10	60	25	0:1
Photo refinder	0	5	5	20	70	5	90	18:1
Boring Interesting								
Baseline system	25	30	25	10	10	55	20	0:1
Photo refinder	0	5	0	15	80	5	95	19:1

Negative = scale 1, 2; Positive = scale 4, 5; photo refinder (scale from -5, higher = better; highest value shown in bold)

Hence, participants felt more interesting to use photo refinder compared to the baseline system. Userlog confirmed that the main reason behind the significant difference is the deleting feature which allows the participants to delete unwanted photographs by using photo refinder system where there are 142 photographs were deleted.

Managing task

Easy: In Table 2, a ratio of 5 participants to 1 found that, the baseline system was easy to use (Mean = 3.90, SD = 1.210) compared to photo refinder where the ratio of 14 participants to 1 found that photo refinder was easy to use (Mean = 4.30, SD = 0.657). There was no statistical significance difference in user’s opinions (easy) across the systems (Wilcoxon signed-rank test, p = 0.252).

Relaxing: A ratio of 3 participants to 1 found that, the baseline system was relaxing to use (Mean = 3.75, SD = 1.118) compared to photo refinder where the ratio of 15 participants to 1 found that photo refinder was relaxing to use (Mean = 4.05, SD = 0.826). This also supported the perceived ease of using photo refinder to perform the managing task. Yet, there was no statistical significance difference in user’s opinions (relaxing) across the systems (Wilcoxon signed-rank test, p = 0.326).

Simple: A ratio of 4 participants to 1 found that, the baseline system was simple to use (Mean = 3.85, SD = 1.137) compared to photo refinder where the ratio of 14 participants to 1 found it simple to use (Mean = 3.95, SD = 0.826). There was no statistical significance difference in user’s opinions (simple) across the systems (Wilcoxon signed-rank test, p = 0.616).

Satisfying: A ratio of 2 participants to 1 found that, the baseline system was satisfying to use (Mean = 3.30,

SD = 1.380) compared to photo refinder where the ratio of 7 participants to 1 found it satisfying to use (mean = 4.10, SD = 0.788). Again, there was no statistical significance difference in user’s opinions (satisfying) across both systems (Wilcoxon signed-rank test, p = 0.058).

Interesting: User’s opinions under ‘interesting’ shows that, a ratio of 2 participants to 1 found that the baseline system was interesting to use (Mean = 3.30, SD = 1.261) compared to photo refinder where the ratio of 7 participants to 1 found it interesting to use (Mean = 4.05, SD = 0.945). There was a statistical significance difference in user’s opinions (interesting) across the systems (Wilcoxon signed-rank test, p = 0.041). Therefore, participants perceived it to be more interesting to use photo refinder compared to the baseline system when performing the managing task. Userlog confirmed that, the main reason behind the significant difference is the predefined tags which provided in photo refinder where participants feel more interesting to select tags instead of writing them.

Since, participants performed keeping and managing tasks in same session, the time taken to perform these tasks was calculated together. The results showed that, the baseline system takes less time on average (Mean = 0:07:20, SD = 0:03:07) compared to photo refinder (Mean = 0:14:33, SD = 0:03:04). A Wilcoxon signed-rank test showed that there is a statistically significant difference in time to perform the keeping and managing tasks between both systems where (p = 0.000089). The results showed clear evidence that, photo refinder took more time to keep and manage photographs compared to the traditional methods to perform these processes (baseline system). There are many situations that participants performed to save time in the baseline system. As an example, some participants copy and paste their original labels for all albums in the baseline system

in order to save their time to write the description about their albums again. Another participant minimized both screens of the baseline system and the folder of his collections then started writing the same labels used for existing albums.

Maintaining task

Easy: In Table 3, a ratio of 5 participants to 1 found that, the baseline system was easy to use (Mean = 4.35, SD = 0.745) compared to photo refinder where the ratio of 18 participants to 1 found that photo refinder was easy to use (Mean = 4.55, SD = 0.605). During the maintaining task, however, there was no statistical significant difference in user's opinions (easy) across the systems (Wilcoxon signed-rank test, $p = 0.372$).

Relaxing: For user's opinions under 'relaxing', a ratio of 15 participants to 1 found that, the baseline system was relaxing to use (Mean = 4.00, SD = 1.026) compared to photo refinder where the ratio of 16 participants to 1 found that photo refinder was relaxing to use (Mean = 4.35, SD = 0.745). This also supported the perceived ease of use of the photo refinder when it comes to performing the maintaining task. There was no statistical significance difference in user's opinions (relaxing) across the systems (Wilcoxon signed-rank test, $p = 0.273$).

Simple: A ratio of 16 participants to 1 found that, the baseline system was simple to use (Mean = 4.30, SD = 0.923) compared to photo refinder where the ratio of 17 participants to 1 found it simple to use (Mean = 4.30, SD = 0.657). There was no statistical significance difference in user's opinions (simple) across the systems (A Wilcoxon signed-rank test, $p = 1.000$).

Satisfying: A ratio of 3 participants to 1 found that, the baseline system was satisfying to use (Mean = 3.65, SD = 1.182) compared to photo refinder where the ratio of 18 participants to 1 found it satisfying to use (Mean = 4.50, SD = 0.607). There was a statistical significance difference in user's opinions (satisfying) across the systems (Wilcoxon signed-rank test, $p = 0.010$). Exit questionnaire confirmed that the main reason behind the significant difference is the features introduced in photo refinder that help participants to track all the changes in maintaining process. Participant 13 quoted that "photo refinder can detect the moved photos easily" and Participant 19 quoted that "photo refinder can track all the changes that happen to albums".

Interesting: A ratio of 2 participants to 1 found that, the baseline system was interesting to use (Mean = 3.40,

SD = 1.273) compared to photo refinder where the ratio of 18 participants to 1 found it interesting to use (Mean = 4.55, SD = 0.605). There was a statistical significance difference in user's opinions (interesting) across the systems (Wilcoxon signed-rank test, $p = 0.002$) in performing the maintaining task. Hence, participants perceived photo refinder as more interesting to use compared to the baseline system. The main reason behind the significant difference could be the drag and drop feature that photo refinder introduced to maintain personal photographs.

For the time needed for the participants to perform the maintaining task, the results showed that, photo refinder took quite less time (Mean = 0:00:26, SD = 0:00:06) compared to the baseline system (Mean = 0:00:27, SD = 0:00:05). A Wilcoxon signed-rank test showed that, there was no statistically significant difference in time to perform the maintaining tasks between both systems, where ($p = 0.681$).

Re-finding task

Easy: In Table 4, a ratio of 1 participants to 1 found that, the baseline system was easy to use (Mean = 2.95, SD = 1.356) compared to photo refinder where the ratio of 18 participants to 1 found that, photo refinder was easy to use (Mean = 4.85, SD = 0.366). There was a statistical significance difference in user's opinions (easy) across the systems (Wilcoxon signed-rank test, $p = 0.000361$). Exit questionnaire confirmed that the main reason behind the significant difference is the features introduced in photo refinder that help participants to complete re-finding task. As example, Participant 14 quoted that, "the options given make it easy to search".

Relaxing: A ratio of 1 participant to 0 found that, the baseline system was not relaxing to use (Mean = 2.65, SD = 1.182) compared to photo refinder where the ratio of 17 participants to 1 found that photo refinder was relaxing to use (Mean = 4.75, SD = 0.550). This also supported the perceived ease of use of photo refinder where the re-finding task is concerned. There was a statistical significance difference in user's opinions (relaxing) across the systems (Wilcoxon signed-rank test, $p = 0.000408$). Exit questionnaire once more confirmed that the main reason behind the significant difference is the features introduced in photo refinder that help participants to complete re-finding task. Participant 3 quoted that "photo refinder reduces the memory recall to remember anything about all photographs".

Simple: A ratio of 1 participant to 1 found that, the baseline system was simple to use (Mean = 2.75, SD = 1.446) compared to photo refinder where the ratio of

17 participants to 1 found it simple to use (Mean = 4.60, SD = 0.598). Similarly, there was a statistical significance difference in user's opinions (simple) across the systems (Wilcoxon signed-rank test, $p = 0.001$).

Satisfying: User's experience under 'satisfying' shows that, a ratio of 1 participant to 0 found that, the baseline system was not satisfying to use (Mean = 2.40, SD = 1.392) compared to photo refinder where the ratio of 18 participants to 1 found it satisfying to use (Mean = 4.80, SD = 0.523). There was a statistical significance difference in user's opinions (satisfying) across the systems (Wilcoxon signed-rank test, $p = 0.000303$). Participant 19 quoted that "photo refinder system offers enough features that help to re-find the photos we are looking for".

Interesting: A ratio of 1 participant to 0 found that, the baseline system was not interesting to use (Mean = 2.50, SD = 1.277) compared to photo refinder where the ratio of 19 participants to 1 found it interesting to use (Mean = 4.70, SD = 0.571). There was a statistical significance difference in user's opinions (interesting) across the systems (Wilcoxon signed-rank test, $p = 0.000265$) when it comes to performing the re-finding task.

For the time needed from participants to perform the re-finding task, the results showed that, photo refinder took less time on average to perform this task (Mean = 0:00:13, SD = 0:00:04) compared to the baseline system (Mean = 0:00:30, SD = 0:00:13). A Wilcoxon signed-rank test showed that, there was a strong statistically significant difference in time to perform the re-finding task between both systems where ($p = 0.000088$). The evidence here was noted from userlog, where participants submitted 194 queries using photo refinder compared to the baseline system with only 58 queries during re-finding task. This means that, the introduced features in photo refinder helped participants to generate more queries to filter their personal photographs which led to reduce the time to complete re-finding task. These results also supported the user's opinions of using photo refinder system to perform the re-finding task.

Although, there was a significant difference in term of time taken to complete keeping and managing time for baseline system, the photo refinder was significant better in terms of interesting opinion for both tasks. Participants took more time to perform keeping and managing tasks. During keeping task, there are 142 photographs were deleted from the photo refinder for many reasons such as repeated photographs not related to the album and

blurred photographs. Major reason was that, the photographs saved were not related to the album saved where there were 83 photographs (58.45%) that had been deleted. This is to justify why participants felt that the keeping task was interesting. The highest user interactions in managing task were the "user write tags" and "user select tags". This also gives a good indicator that participants felt that, it was interesting when using photo refinder by selecting the predefined tags. Analysis from total interactions with photo refinder discovered that participants preferred to choose predefined tags (28.17%) compared to writing them (26.69%). This provides strong evidence that photo refinder mostly helped to facilitate the participants in the managing process compared to the baseline system. For maintaining task, the results showed that, there was no significant difference in term of time taken to complete the task between the systems; meanwhile the results showed that participants perceived photo refinder as satisfying and interesting. These results could be justified based on the features used in the system to support maintaining tasks such as events timeline and album action bar. Finally, the features provided in photo refinder (e.g., search by events, search by people and search by places) played an important role to facility re-finding task for all participants. Participants were able to complete re-finding task significant faster compared to the baseline system with also higher satisfaction in terms of easy, relaxing, simple, satisfying and interesting. The results indicate that supporting PIM processes (keeping, managing, maintaining and re-finding) facilitate people to effectively retrieve their photograph collections.

CONCLUSION

In this study, we showed user's opinions in performing PIM processes in a user experiment. User's opinion in performing four tasks with photo refinder and the baseline systems was compared. For our future research, researchers plan to focus more about the features introduced in photo refinder and examine how these features support users in performing PIM processes. We will look in depth at the features that support different re-finding tasks.

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