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Jarno Ojala

Studies of Content-Mediated Interaction

Insights into Activities, Motivations and User Experience Design

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Abstract

The amount of user-generated digital content in social media has exploded during recent years. Currently, it is easy to capture and produce versatile personal content, for example, activity data that is recorded with devices, such as heart rate monitors or the preference data of the music you listen to. A plethora of services exists for content sharing. Sharing digital content, such as images, audio, and video allows people to express themselves, create new contacts, strengthen ties with existing contacts, and to collaborate with other people. Social activities through content can create a sense of belonging and being part of a community. Digital content *mediates* social interaction through online services. For example, a shared video tells someone the story of an event that they could not be physically present at, and then shared exercise data might inform others of an interesting cycle route for a specific type of exercise. The sharing of traditional, personal digital content such as photos and videos has been widely studied, but recently it has become increasingly common to produce different types of content collaboratively and various services enable social interaction around such content – not just the sharing of it. The guidance for designers on how to build services to enable users to engage in these interactions naturally is still limited. To design better services, we need a better understanding of user activities together with the shared content and the collaborative practices that they form. Thus, this work focuses on novel types of user-generated digital content as well as the related activities, motivations, and user experiences.

This compound thesis contributes to the research field of human-computer interaction; more specifically, the user experience. The thesis contains findings from six user case studies, involving a total of 328 participants. Through the case studies, we identified the elements that contribute to the user experience of content-mediated interaction with various content types. The theoretical contribution of this work is the introduction of the concept of *content-mediated interaction*. This work identifies the different elements that affect *content-mediated interaction*, and builds a *content-mediated interaction* model. The work extends the knowledge of user activities and the related user experience with novel types of shared content and of the user's motivation to participate in content-mediated interaction. As a practical outcome, the thesis presents design implications. The thesis first proposes that understanding content-mediated interaction helps to design better applications and services that support online social interaction. Second, this helps to evaluate and refine the existing services as well as understand the emerging new content types in the future. Understanding the underlying activities and motivations supports the creation of new interaction features, service concepts, and finally, identifying business prospects.

Preface

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List of publications

The compound thesis consists of a summary and the following six original publications:

P1 Ojala, J. 2013. Personal content in online sports communities: motivations to capture and share personal exercise data, *International Journal of Social and Humanistic Computing,* 2 (1-2), 2013, 68-85.

Ojala was in charge of the trial execution and writing of the article.

P2 Ojala, J., Mate, S., Curcio, I., Lehtiniemi, A., Väänänen-Vainio-Mattila, K. 2014. User trial of collaborative creation of automated mobile video remixes in different contexts, In Proc. *Conference on Mobile and Ubiquitous Multimedia*, MUM'14, 170-179.

Ojala was in charge of the trial execution and did majority of the writing of the article.

P3 Ojala, J., Väänänen-Vainio-Mattila, K., Lehtiniemi, A. 2013. Social Camera – Trial and Evaluation of Mobile Photo Sharing Service for Small Groups, In Proc. *Conference on Advances in Computer Entertainment*, ACE'13, 344-355.

Ojala was in charge of the trial execution and writing of the article.

P4 Ojala, J., Vyas, D., Lehtiniemi, A. 2013. Group simulation: Introducing participatory technique for evaluating photo sharing interfaces with early prototypes, In Proc. *Conference on Human Factors in Computing and Informatics,* SouthCHI'13, 36-53.

Ojala was part of the trial planning, in charge of the execution and carrying out the study. Ojala was responsible of the writing of the article.

P5 Ojala, J., Fedosov, A., Olsson, T., Väänänen, K. Langheinrich, M. 2017. "Shared online. Made people envious. Felt good": Motivations to share emergent types of content online, SUBMITTED MANUSCRIPT: *Interaction Design and Architecture(s) Journal*, 2017.

Ojala was in charge of the survey execution with Anton Fedosov and held the main responsibility of the writing of the article.

P6 Lehtiniemi, A., Ojala, J. Väänänen, K. 2016. Socially augmented Music Discovery with Collaborative playlists and Mood Pictures, *Interacting with Computers*, 2016, 1-22.

Ojala took care of conducting the study and was the main responsible for the writing of the article. Ojala took part in the application design, while Lehtiniemi held main responsibility of its design and lead the implementation.

List of acronyms

CMI	Content-mediated interaction
CSCW	Computer-supported collaborative work
HCI	Human-computer interaction
HCD	Human-centered design
ISO	International standardization organization
SNS	Social network sites
UCD	User-centered design
UGC	User-generated content
UX	User experience

1. Introduction

This chapter first describes the background and motivation for this thesis work. Second, it presents the research scope and questions, reflecting on their relevancy to both academia and the practical design audiences. Third, it gives an overview of the research process, studies, and publications. Finally, it lists the contributions to this thesis.

1.1 Background and Motivation

People are increasingly interested in personally creating content, such as images, audio, and videos, as well as sharing this content on social networking services. Creating content has become increasingly common using state-of-the-art devices and modern technology. Sharing user-generated digital content dominates online services, and creates the core of many social media and social networking services. Internet services that are built on user-generated content (UGC), for example, social media and social networking services (SNS), are dominating online service use. Figures taken in August 2016 showed that five out of the ten most commonly visited web sites in the world were based on UGC (http://www.alexa.com/topsites).

In this work, the term *content* refers to a broad range of created, recorded, measured and further edited *multimedia content entities*. Importantly, this thesis focuses on content that is shared with other users. This thesis investigates content types from user-generated multimedia content, such as photos and videos, to automatically recorded data, such as physical activity data as well as digital representation of shared physical resources, such as apartments. Personal inventory on a user's own device is not in the focus of this work.

The phenomenon of online content sharing is not a novel concept. It has existed since the early nineties- from the early development of the Internet. However, the explosion of sharing user-generated digital content has happened with the wide adoption of personal computing and smart phones. In the era of online communities and discussion forums, shared content was mostly textual, but the development of data transfer and the capturing and viewing possibilities of devices have enabled the sharing of various media forms. The variety of content types, which can be created with a personal device and shared instantly, is growing. Novel content sharing services enable, for example, the sharing of health data (for example, Endomondo), the sharing of one's physical resources (sharing economy services, for example, AirBnB, Uber), *instantly or ephemerally* sharing content (Snapchat), or *broadcasting and streaming* captured content (Periscope), which is leading to new kinds of interactions between users.

Sharing content *mediates* social interactions between users of social media services and online communities. For example, an interesting video shared on YouTube at the right moment can evoke feelings and hundreds of comments and video responses from both contacts and strangers, and sharing a photo of a meaningful trip with family members can start a lively conversation within the close social circles of the sharer. This thesis focuses on activities related to content-mediated interaction, not just sharing. Users are able to collaboratively produce content with their mobile devices, as well as enrich existing content and modify it for new content entities. This thesis defines the activities and motivations that relate to content-mediated interaction.

A fundamental challenge in the design of content sharing services is the *socio-technical gap*. Ackerman (2000) defines this as a divide between what we know we must support socially and what we can support technically. The socio-technical gap related to content sharing has two clear dimensions: some traditional social habits are not supported technologically, and users do not yet understand some of the new functionalities that technology offers or these habits have become social norms. For example, as sharing to larger audiences has become easier, users are struggling with controlling the target content for the right audiences. Another fundamental design problem is keeping the balance between a user's privacy and their ability to share content. Automatic sharing features have affected the way users perceive sharing personal content. Thirdly, many of the previous works suggest that there is a fundamental difference between the amount of created content and consumed content, and therefore, motivating users to become creators of quality content is important (Bernstein et al. 2010, Agichtein et al. 2008, Beenen et al. 2004). Novel services offer lightweight methods of contributing, for example, enriching the content that others have created in many ways and even contributing through consumption.

In the current online realm, people use many services, devices, and applications to reach different audiences and to manage and share different types of content (Litt & Hargittai, 2016a; 2016b). Many previous studies approach the activities that this work terms as "content-mediated interaction" with a focus on single platforms or applications, whereas this work focuses more broadly on the user activities related to content-mediated interaction.

This research aims to form an understanding of content sharing from the user experience's viewpoint and to contribute to the field of human-computer interaction (HCI). More specifically, the work focuses on better understanding users' activities and motivations and finally designing a pleasurable user experience (UX) for services that enable content sharing. The research studies the design solutions, which support and motivate users in content-mediated interaction and improve the user experience. The theoretical contribution of this work is about identifying the activities, motivations, and the user experience that occur in content sharing in the context of various novel types of content, such as collaboratively

created videos, photos, and music preferences. We approach social interaction through *activities* with content: activities that have social purposes and relate to content or are mediated by content. Since *sharing* itself is merely a step in the range of activities, the work introduces the concept of *content-mediated interaction* (CMI). The CMI model describes the elements that affect the user experience related to content-mediated interaction. Activities are defined as high-level goals, to which users aim at by performing tasks through interactions on the user interface level (Rosson and Carroll, 2002). Understanding the activities supports a high-level design of services that enables CMI. The contribution of this thesis is on the activity design level.

Research is exploratory and qualitative by nature, emphasis being on understanding the CMI. The thesis work aims at theory building (Eisenhardt & Graebner, 2007) for a general model of CMI. This research aims to provide an in-depth understanding of the underlying motivations and activities in CMI, regardless of the content type or the service. In this thesis, it is acknowledged that content types differ. Therefore, we have studied a broad range of content and built a model to reflect the versality of the content types and the affecting factors. However, it is out of the scope of this qualitative research to compare the CMI with different content types. The thesis suggests that understanding the elements that contribute to CMI helps with designing better applications and services with respect to the social elements of the user experience. Moreover, the CMI model builds a foundation for understanding CMI as a whole. Results help advance the understanding of new types of digital media content and ways of interacting with them as they emerge.

1.2 Research Scope and Questions

The main goal of this thesis is to understand and define content-mediated interaction, and to interpret the elements that contribute to content-mediated interaction and the related user experience. This thesis contributes to the research field of human-computer interaction (HCI), more specifically addressing the field of user experience (UX) by bringing users and their behaviour and experience of use into the focus. The thesis investigates the following three research questions:

RQ1: What are the external elements that contribute to content-mediated interaction and the related user experience?

The first research question focuses on external elements that affect content-mediated interaction. External elements are other than user's internal factors, such as motivations and performed activities. The first research question addresses the problem of the socio-technical gap, by bringing design of technology and social behaviour closer to each other. The first

research question is addressed by building the theoretical *content-mediated interaction* model. The model advances the knowledge of the different digital content types, service features, the notion of social context, and how they affect design. The model can be used in the evaluation, design, and refining of the services and applications that relate to activities with content. Additionally, the thesis discusses what kinds of experiences arise from the use of systems in this particular field.

RQ2: What are the user activities and motivations in content-mediated interaction?

The second research question focuses on the internal factors of user that affect content-mediated interaction. The research question identifies the activities in *content-mediated interaction* as well as the questions: how and why is digital media content *consumed, created, shared, enriched,* and *followed*? Additionally, it addresses this research question by identifying the user's motivations that affect content-mediated interaction.

RQ3: What kind of design solutions support participation in content mediated interaction?

The goal of the third research question is to create an understanding of user needs for technology, desired features, and design in relation to content-mediated interaction. This work identifies the design implications that contribute to the user experience and provide understanding of how the positive user experience related to content sharing can be supported. The third research question addresses the user's dilemma in keeping control of one's content and privacy while being able to share the content.

1.3 Contributions

The empirical part of this thesis consists of five case studies and an online survey, presented in six publications. Table 1 below shows the key contributions of each publication and their relation to the research questions.

Publication	**Key contributions to RQ1:** What are the external elements that contribute to content-mediated interaction and the related user experience?	**Key contributions to RQ2:** What are the activities and motivations in the content-mediated interaction?	**Key contributions to RQ3:** What kind of design solutions support participation in content mediated interaction?
P1	-	Insights into the activities and motivations of sharing data on online sports communities.	Understanding the features that support content-mediated interaction with exercise data.
P2	Understanding the elements that support content-mediated interaction in collaborative video creation.	The motivations to participate and contribute content to collaborative video creation.	CMI in event-based, automated collaborative video creation.
P3	External elements of CMI in instant photo-sharing applications.	What motivates users to share with a small group? Understanding the instant content consumption and sharing.	Understanding the features that enable instant photo-sharing.
P4	Content enrichment within the small group.	-	Design implications for small group photo-sharing applications.
P5	Identifying the elements that affect CMI in emergent content sharing services.	Understanding the motivations in CMI. Reflecting motivations to the positive and negative experiences of sharing novel content types.	Understanding the features that support positive user experiences related to content-mediated interaction.
P6	Social usage patterns in collaborative music discovery.	Activities related to user-generated content and the motivations to create it during the trial.	The design implications of social music discovery services.

Table 1. Key contributions within the publications

The research has been conducted in various group and community formations and with different types of content in the case studies. A more detailed description of the content types is given in the "research design and methodology" section. The publication overview in Table 1 shows how the research questions are addressed in the different publications. This thesis sees shared content as a *mediator* of the social interaction online. While previous research has mostly focused on content sharing and consumption, this work addresses content-mediated interaction more broadly, and considers all the other activities in addition to sharing.

This work contributes to the knowledge of the user experience (UX) by constructing a model for *content-mediated interaction* (CMI). The model assists designers of services and applications that enable content-mediated interaction by giving insights on the user's activities and motivations. The research identifies the elements that contribute to content-mediated interaction. As the work focuses on the elements that generally occur in content-mediated interaction, the comparison of the specific differences on the different types of content is not in the focus of this work. The research gives practical advice for designers of services that support content sharing and social interaction. Furthermore, this work identifies the activities and motivations that occur in media content sharing regardless of the content type. The work builds a model to help the designers of services and applications that support content sharing to build services with a better user experience in mind. Understanding the activities supports design of services that enables CMI. Thus, the contribution of this thesis is on the activity design level. Additionally, the work identifies design implications, offering new possibilities to design user experiences for content-mediated interaction.

The thesis has two outcomes that are applicable to the practice of UX design. From a practical point of view, the CMI model identifies elements that affect content-mediated interaction and the related user experience. The model is applicable to the design of such services. It addresses questions **RQ1** and **RQ2**. The second practical outcome is to highlight design considerations for systems that enable content-mediated interactions from the findings of the case studies completed in the research process. Design implications link directly to question **RQ3**. These objectives are fulfilled in the results section of this thesis.

1.4 Overview of the Research Process

The thesis includes publications from five case studies and an online survey. Studies were completed using a wide selection of relevant content types to understand user experience in content-mediated interaction: exercise data, pictures, musical playlists and music preferences, videos, shared physical resources, food/dietary information, activity data, travel data, and virtual possessions. To understand the general user experience in content-mediated interaction, a wide selection of content types was included in the thesis. Studies started from

more traditional content types and moved toward novel types of content sharing. The content types and sharing contexts studied include: 1) a case study with exercise data in an *online community* context, 2) three cases with photo sharing, mostly between small groups, 3) a case study with collaborative videos, in an *event-based and limited community,* 4) a two-phased study with music and collaborative playlists, with *limited groups*. In the final phase, the research was validated and the model expanded with an online survey studying sharing six emergent categories of "things": music preferences; travel plans; sports activity; real-world rooms and vehicles; virtual items in online games; and dietary preferences. The online survey gathered 200 responses.

This research excludes document and file sharing as a content type, since they are widely researched, especially in the work and business environment. The thesis concentrates on the *user-generated* content, especially media types that can be socially produced or *enriched*. Research is *exploratory* and *qualitative* by nature, and it aims to understand the studied phenomenon in depth.

1.5 Structure of the Thesis

The first chapter presents an overview on the topic and the scope for the research, and finally describes the work's research questions and contributions. The second chapter gives an overview of the concept of *content-mediated interaction* and discusses related work on content activities. Chapter 3 describes the concept of the *social user experience,* connecting it with audience control and users' desires to engage the audience. Chapter 3 defines the research gap for this work. Chapter 4 describes the methodology and details of the methods used in the different case studies. Chapter 5 discusses the results of the case studies and presents the theoretical contribution of the thesis. In this chapter, the results of the case studies are presented study by study. In chapter 6 the results are suggested as practical implications in the form of design considerations. Finally, chapter 7 discusses the limitations, future work, and gives the conclusions.

2. Framing Content-Mediated Interaction

First, this chapter describes the central concepts of work and presents an overview of the concept of content-mediated interaction, which is the main theoretical contribution of this work. The chapter presents the related work on the area of content sharing and the related activities with content, reflecting upon it with the concept of content-mediated interaction. The motivation for this work is given by revealing the research gap found in the studies related to content sharing. Then the services and systems that enable activities in content-mediated interaction are presented. Finally, the chapter introduces the related work on the motivations to participate in content-mediated interaction.

2.1 Central Concepts

Content: Content in HCI is a general term for digital media formats and their combinations, such as textual data, documents, audio, still pictures, and video. Multimedia by Heller's and others' definition is a seamless integration of two or more media (Heller et al. 2001). This thesis investigates a wide span of content types from user-generated multimedia content to automatically recorded data, such as physical activity data and digital representation of shared physical resources, such as apartments. In the latter, the digital representation is a compound content entity that consists of the item's description, announcements and additional photos or other digital files. Importantly, this thesis focuses on content that is shared with other users online, and thus have become socially available.

User-generated content (UGC): as in opposition to commercial content, is defined as content that has been created by users and shared in a certain service. It is content that is personally created, generated, remixed and/or captured partially or fully by the users. *Personal content* is described by Lehikoinen et al. (2007) as the daily communications, photos, music and digital content that users interact with or have personally created either implicitly or explicitly with their digital devices. In this work, the term content refers to user-generated content (UGC) but also commercial content that has been shared or mediated by the user, as in the personal content definition by Lehikoinen (2007). Commercial content that a user has shared, for example by retweeting, creates a connection to the user profile or username in the service, thus creating a connection to the user.

Personal information management (PIM): The activities that people perform in order to acquire, organize, maintain, retrieve and use personal information, such as paper or digital documents, web pages, mail, messages and other forms of digital media, in order to complete tasks (Jones, 2008).

Activity: An action performed by a person or a group of people in order to obtain a desired outcome (Engeström, 1987; 1999). Activity is described as a form of *doing* that is directed towards an object (Kuutti, 1995). Activities are high-level goals, to which users aim when using the systems (Rosson & Carroll, 2002). Activities consist of *tasks,* which are smaller steps in activities. Users perform tasks by *interacting* with the system on the user interface level (Rosson & Carroll, 2002). This work focuses on the user activities that are directed to or related to content items. Activity design aims for designing functionalities that offer help for reaching goals and objectives (Rosson & Carroll, 2002).

Interaction: *Activities* are high-level goals to which users aim by performing tasks through *interactions* on the user-interface level (Rosson & Carroll, 2002, Kuutti, 1995). Affordances and features of the service or system either offer help or prevent users in these activities (Rosson & Carroll, 2002). Interaction design concentrates on the level of manifesting the interactions on the user interface level (Preece et al. 2015; Sundar, 2008).

Content-mediated interaction (CMI): This interaction consists of activities and communication between two or more parties. Specifically, this thesis focuses on the user interactions between people that is mediated by content. CMI extends PIM by understanding the activities, motivations and social dimension of the content.

Model of content-mediated interaction: The model describes the elements that centrally affect the user experience related to *content-mediated interaction*.

Social context: Social context includes other people that may also be virtually present and acting as contacts and an audience in the system – as well as those that are physically present. Both affect the content-mediated interaction.

User experience (UX): "a person's perceptions and responses that result from the use or anticipated use of a product, system or service" (ISO 9241-210). The more detailed positioning of this work on the UX field is given in chapter three.

Social user experience (Social UX): A person's perceptions and responses from the use of a product, system and service in which the emphasis of use includes other users of the system as a social context. The social user experience occurs in services and applications where other users are actively involved in the use of the system and which enables interaction between users by utilizing the system functionality and shared content. The social user experience is defined in a more detailed manner in section 3.4.

Social network service (SNS): Term social network service denotes a networked communication platform, where users have profiles and are able to share their content.

Social media: An umbrella term that includes SNSs, instant messaging and ephemeral messaging systems and systems that enable activities with content.

2.2 Content-Mediated Interaction

This chapter introduces and defines the term *content-mediated interaction*, which is the main conceptual and theoretical contribution of this thesis. Content-mediated interaction includes the activities that users perform with the content, and that have a social purpose. Thesis expands the range of activities from the widely studied content sharing. The following sections describe why this work is needed in the field, and how it furthers the knowledge of this topic.

Mediation is a term that was originally introduced by Vygotsky (1978). Vygotsky discussed mediated learning and mediation of a stimulus and response with different tools and concepts. In HCI, the term refers to mediation of shared activities and communication between people through technology. Computer supported cooperative work (CSCW) is a field of HCI that specializes in the ways of working together in collaboration and the solutions that enable it. CSCW, as a field, studies the way people collaborate with the enabling technologies, for example, computers and other information devices. In the CSCW, the mediation is done by the enabling technology between the collaborating partners. In media studies, *mediated communication* is defined as any technical medium used to transmit knowledge (Davis, 2000) whereas computer-mediated communication (CMC) is defined as human communication through the use of two or more electronic devices (McQuail, 2005). Zoric et al. (2013) have defined *content interaction as* the user's interactions with the created multimedia content – including manipulation and controlling the viewing experience. Juhlin et al. (2014) extended the work with video sharing.

User experiences are evoked by the use of technological products, but there are numerous other aspects that affect the experience. Raita (2015) introduces *technology-mediated experiences* as experiences that are affected by social interaction and other users of the system and those that are not actively participating in the system. Raita (2015, p. 3) emphasizes the importance of the social dimension in the user experience: "relationships to other people are always part of our user experiences – even when we are ostensibly by ourselves." Content-mediated interaction happens with the help of technology, when technology mediates the *interaction* between people, or enables shared *activities* for groups of people through shared content. Content-mediated interaction is human-to-human interaction, which is mediated by technology and more specifically by shared content, which can be seen as the medium that conveys the message.

The user experience related to personal content has been widely discussed in the work by Lehikoinen et al. (2007). Their work introduces the content lifecycle model GEMS (Lehikoinen et al. 2007). The GEMS-model includes four phases: *get, enjoy, maintain* and *share*. Arrasvuori and Olsson (2009) have further refined the online community participation

work by Preece and Maloney-Krichmar (2002) and drawn a model for analysing online communities. The participation activities in their model are divided into content and people related activities. Content related activities consist of *access, create, enjoy, enrich, maintain and share* (Arrasvuori & Olsson, 2009). This model was introduced in the book *Personal Content Experience* (Lehikoinen et al. 2007). In their GEMS model, the activities have been condensed into *get, enjoy, maintain* and *share*. The content-mediated interaction model with its five activities is adopted from the phases in the GEMS model by Lehikoinen et al. (2007).

Managing one's own collections and sharing personal content has been widely studied. Personal archiving and collecting one's personal content *repository* is a starting point to content sharing. The tools, means and habits of archiving (Sease & McDonald 2009, Whittaker 2008) as well as the possession of digital artifacts (Odom et al, 2009, Odom et al. 2011) have been widely researched. This thesis scopes out the personal information management as a widely researched area. However, in the CMI process, managing one's personal collection is seen as a part of the *content creation* activity.

This work focuses on the activities and interactions that users perform with the content broadly. Content-mediated interaction as a theoretical concept extends to the previous work on content sharing, which has concentrated on the *sharing* part in CMI solely. CMI describes the activities with content more broadly, suggesting that users perform different activities around the content. These activities can change over time or during different use sessions of a service, and users can perform different activities.

The process of experiencing the content includes three kinds of interactions (as described in Figure 1): 1) direct interactions between the users, 2) interaction with the system itself or its user interface, 3) content-mediated interactions between the users mediated by the content in the system, which is visualized in Figure 1 as the content-mediated interaction arrow. Content-mediated interaction takes place through the service and content-sharing possibilities, where direct interaction takes place outside the system including, for example, discussions about shared content (Figure 1).

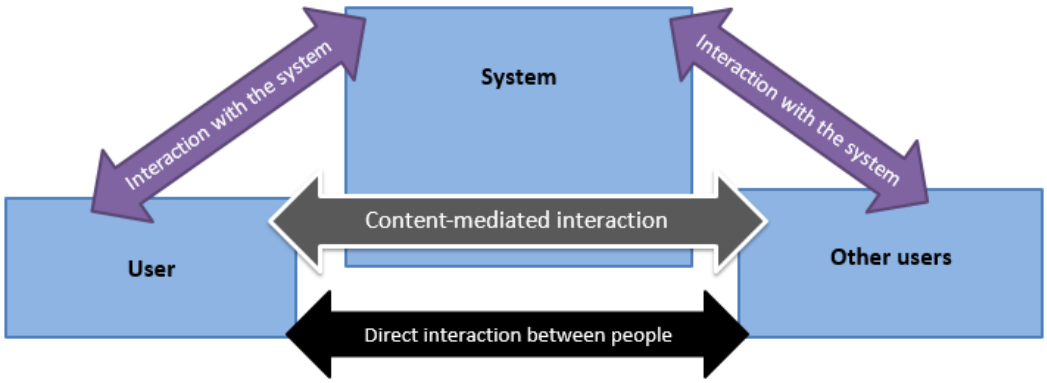

Figure 1: Interaction types: direct interaction, interaction with the system and content-mediated interaction

Figure 1 describes the different interaction types that affect the user experience in activities with content. In Figure 1, the purple arrows denote the interaction with the system, using the user interface level elements and basically performing human-computer interaction. The black arrow denotes the direct interaction between people, which is human to human interaction that happens without the use of the system. The blue arrow denotes the content-mediated interaction. Figure 1 is simplified and it visualizes the different interactions that relate to CMI. Following parts explain how they overlap and occur parallel in activities with content.

Direct interactions happen when people interact directly without the help of the system. An example is face-to-face discussions, which may be initiated by the shared content. *Interactions with the system* include actual usage of the system as in the traditional HCI. In this interaction, the usability and interaction design supports the pleasurable use of the system. An example of an interaction with the system is low level human-computer interaction, where the user types in a search for a certain song in a music service such as Spotify. Finally, the content-mediated interaction is an interaction between people, mediated and facilitated by the *content* shared in the *system*. It is human-to-human interaction mediated by technology, more specifically the shared content. A simple example of this kind of interaction is *sharing* a holiday picture on Facebook. Then the content-mediated interaction may continue when another user *enriches* the content by commenting or re-sharing it.

In activities with content, all of these three interactions can occur, and they can be overlapping. For example, in a collocated situation where a discussion (direct interaction) about a shared video (shared by interacting with the system) occurs, content-mediated interaction is created. Content-mediated interaction and direct interaction can overlap when, for example, a user shows a picture from her device screen to others in a manner of direct interaction, but without sharing in a system. While all of these three different interactions

affect the user experience, content-mediated interaction is in the focus of this work. The focus is on the level of activities with content rather than interaction with the system. The activities and the elements that affect content-mediated interaction are described in the results section.

2.3 Related Work on Services Enabling Content-Mediated Interaction

Content-mediated interaction includes different activities that users perform with the content. The identified activities are described in the results section. This thesis addresses collaborative activities, such as *sharing* and *enriching* the content. The following sections describe how the user activities are studied in earlier works. A work by John (2012) defines how the term *sharing* is generally understood in Web 2.0. services and which user activities are involved. John (2012) emphasizes that sharing one's life and experiences is a phenomenon that happens through sharing different items of content in the SNS's. John (2013) distinguishes two logics behind the term sharing – *distributive* and *communicative*. Sharing as an act of *distribution* means dividing a piece of something to someone when that shared item is a limited resource, for example, an apartment that is rented to another person for a time that it is not in use (Finck et al. 2016). Sharing can be also an act of *communication* when we talk about sharing our feelings and emotions. In *communicative* sharing, the shared item is not limited or lost in the act of sharing. For example, sharing photos online is an example of communicative sharing of an experience. Similarly to John's definition of communicative sharing, Knorr-Cetina (1997) introduced term *knowledge objects* as objects that are not limited resources and have a "capacity to unfold indefinitely", meaning that they evolve over time as users are able to modify them. Voida et al. (2005) studied technological affordances and user practices of file sharing, including web folders and peer-to-peer systems as a form of communicative sharing.

Naaman et al. (2010) identified two main forms of user participation in Twitter: *informers* share and re-tweet information where as *meformers* publish about themselves. Joinson (2008) presented extensive data on the user activities of Facebook. Joinson's work describes seven main categories of activities: social connection (keeping in touch), social browsing (browsing familiar people), photographs (viewing, tagging, sharing), content (applications and games), social investigation, social network surfing (new connections) and status updates. Belk (2008) defines two types of sharing habits: "sharing in," when the content is shared with known small circles and to keep up with old contacts, and "sharing out," when content is shared with new audiences to socially outreach to new contacts. Both of these sharing habits are present in the content-mediated interaction activities, which are described in the following sections.

Social network sites (SNS) are by definition computer-mediated services that allow users to share their own content, integrate content and interact with others (Iriberri 2009). Ellison and Boyd (2013) presented a novel definition of SNS. They characterized it as a networked communication platform in which participants 1) "have uniquely identifiable profiles that consist of user-supplied content, content provided by other users, and/or system-provided data", 2) "can publicly articulate connections that can be viewed and traversed by others" and 3) "can consume, produce, and/or interact with streams of user-generated content provided by their connections on the site." In this thesis, the notion of social media includes online communities (such as stackoverflow.com), social networking services (such as Facebook and Twitter) and additionally some newer forms of social applications such as Firechat, Snapchat and WhatsApp. The new forms of social activities online are built upon lightweight sharing services, which enable communication and content sharing without the community platform. Examples of such services are Dropbox and WhatsApp.

As most of social media services are fundamentally built on the UGC shared in them, the content contributions are essential for the services. The work of Jiang et al. (2010) suggests that the amount of all interactions is 16 times greater than the amount of visible interactions, and content consuming dominates over content creation. Fundamentally, discovering interesting content is the main motivator of using the services. In social media, seeing the high-quality content of others (Agichtein et al. 2008) motivates newcomers to add their own content to the services (Bernstein et al. 2010). Social media and SNS's are either Web 2.0. or Web 3.0. services. Web 2.0. emphasize the user-generated and shared content and Web 3.0. emphasize the collective intelligence, automatic recommendations, targeted content and smart semantic web solutions.

A major part of the use of social media and personal content management nowadays happens with mobile devices such as smart phones, tablets and hand-held devices. The thesis work by Cui (2013) looks into the use of social networking services on mobile devices. Cui introduces key *user experience dimensions* in the SNS use with mobile devices. The main dimensions in the model are *awareness, social interactions, self-expression, usability, sense of control* and *breadth of content access*. Cui emphasizes the meaning of *social awareness* through social media services; for example, mobile devices allow perpetual checking of updates online. The thesis work by Malinen (2016) deepens the understanding of the *sense of community* (SOC) in the SNS's and online communities. SOC is one of the main reasons to participate in the social media (Malinen, 2016). This work deepens the understanding on the motivations to participate in *content-mediated interaction,* and what motivates users to become content contributors to social media.

Previous work related to personal content has focused on content management and experiences with personal computers and smartphones (Lehikoinen et al. 2007, Odom et al.

2011). A major part of digital personal content management requires creating and maintaining inventories and collections (Odom et al. 2012) of personal media (Bentley et al., 2006) and sharing the meaningful content with others, and this has become an interesting area for research and development. Personal information management (PIM) and managing personal collections are widely studied areas that are mainly focusing on the habits and bottlenecks of collecting and maintaining personal content collections. The evolution of personal content management can be roughly divided into three phases: 1) personal content management 1.0.: managing personal content over one's own devices and personal computers, mostly in a desktop platform, 2) personal content management 2.0.: social networking services, peer-to-peer networks and sharing content online, 3) personal content management 3.0.: pervasive cloud computing, where content is managed from a cloud storage and service, and the devices are merely "thin clients" for searching and browsing the online collections and cloud folders. In web 3.0., it is fundamental that the services and content in them are accessed with many devices with different inputs and display capabilities. The use of many devices to perform the user activities has been widely studied (Jokela et al. 2015, Kawsar et al. 2014). Studies draw implications on how the multiple devices affect the design of these services.

The work of Lindley et al. (2013) discusses how web services can be reconsidered as new personal inventories. Lindley et al. defined five types of web content collections: high value collections, collections that are curated online, collections that emerge through use, content for consumption in the moment and dynamic content such as profiles and personal pages.

Numerous studies have been completed on content sharing. Table 2 lists services for sharing certain types of content. The table describes the content type that has been addressed in the studies of the thesis.

Content type	Examples of services	Research on the content type	In the thesis
File sharing (documents etc.)	Dropbox, iCloud, OneDrive, Google Drive	Olson et al. (2005), Odom et al. (2012)	Not included
Textual data (tweets, status updates)	Twitter	Marwick & boyd (2010), Litt and Hargittai (2016 a), Litt & Hargittai (2016 b)	Not included
	Facebook	Wang et al. (2011), Joinson (2008), Karnik et al. (2013), Sharma & Cosley (2015), Uski & Lampinen (2014), Väänänen-Vainio-Mattila et al. (2010), Vitak et al. (2015), Lampe et al. (2013), Smock et al. (2011)	
	Google +	Kairam et al. (2012)	
	Jaiku, Ello, MySpace	Vihavainen et al. (2014)	
Knowledge sharing	Wikipedia	Nov et al. (2013), Antin et al. (2012)	Not included
	MovieLens	Fugelstad et al. (2012), Beenen et al. (2004)	
	Everything2.com	Lampe et al. (2010)	
Photos	Instagram, Flickr, Facebook	Goh et al. (2009), Malik et al. (2015), Frohlich et al. (2002), Kirk et al. (2006), Kindberg et al. (2005), Miller & Edwards (2007)	**Included, P3, P4**
	MMM2	Van House et al. (2005), Van House et al. (2009),	
	Photocloud	Vartiainen & Väänänen-Vainio-Mattila, (2010)	
	MobiPhos	Patel et al. (2009), Van House (2011)	
	Mopix	Lindtner et al. (2011)	
	Social Camera, Moodphotos	Cui et al. (2013), Vyas et al. (2012)	
Videos	MGroup, Media Stories	Salovaara et al. (2006), Lehmuskallio et al. (2008)	**Included, P2**
	YouTube, Vine, Vimeo	Juhlin et al. (2014). Engeström et al. (2008), Kirk et al. (2007), Marshall & Shipman (2013)	
	AVRS	Vihavainen et al. (2011, 2012, 2014)	
Music and preferences	Spotify, Soundcloud, Myspace, Deezer	Bentley et al. (2006), Lehtiniemi et al. (2016), Lehtiniemi & Ojala (2013), Lehtiniemi & Ojala (2014)	**Included, P6**
	Last.fm	Uski & Lampinen (2014), Silfverberg et al. (2011)	
	iTunes	Voida et al. (2005)	
Travel data	Voyage	Aizenbud-Reshef et al. (2012)	**Included, P5**
	Dopplr	Väänänen-Vainio-Mattila et al. (2010)	
Personal exercise and activity data	Endomondo, Sportstracker, MapMyRun,	Ahtinen et al. (2008), Prasad et al. (2012), Väänänen-Vainio-Mattila et al. (2010), Munson & Consolvo (2012), Mueller et al. (2010)	**Included, P1, P5**
	Movescount	Ojala & Saarela (2010), Malinen & Ojala (2011)	
Virtual possessions	SecondLife, Minecraft	Neustadter (2009)	**Included, P5**
		Odom et al. (2012)	
Food and diet information	Giallo Zafferano, Foodspotting	Davis et al. (2014)	**Included, P5**
Shared resources, rervices and artifacts (sharing economy)	Uber, Couchsurfing, Snapgoods, AirBnB	Bellotti et al. (2015), Ikkala & Lampinen (2015), Lampinen & Cheshire (2016)	**Included, P5**
	Huuto.net	Malinen & Ojala (2011), Malinen & Ojala (2010)	
Instant messaging, broadcasting and streaming	Snapchat, Periscope, Facetime, Skype, WhatsApp, Firechat	Xu et al. (2016), Bayer et al. (2015)	Not included
Location sharing, location-based games	Foursquare, PokemonGO, Layar	Wiese et al. (2011), Weiser et al. (2015)	Not included
	MyTerritory	Lehtiniemi & Ojala (2012)	
Cross-service or cross-content studies		Litt & Hargittai (2016b), Marshall & Shipman (2011; 2013), Vitak (2012), Goh et al. (2009), Burke et al. (2009), Bentley et al. (2006), Sleeper et al. (2016)	Not included

Table 2: Overview of content types and services studied in the related work

As Table 2 describes, the thesis research has addressed a plethora of content types. The content types presented in the table were selected based on the earlier literature on content sharing, the listing of social media sites in Wikipedia (https://en.wikipedia.org/wiki/List_of_social_networking_websites) and the most visited websites listing (https://en.wikipedia.org/wiki/List_of_most_popular_websites). Previously, sharing and creating traditional digital content, such as photos and videos has been widely studied. Earlier work (Van House et al., 2011; Frohlich et al. 2002; Kirk et al. 2006) describes the process of photo sharing and activities that users perform after taking photos. Studying the activities is extended to videos (Lehmuskallio et al., 2008; Kirk et al., 2007) and the collaborative creation of videos (Juhlin et al., 2014; Vihavainen et al., 2012).

There are some fundamental problems that users, designers and services as a whole face. First of all, there is a user problem, socio-technical gap, which Ackerman (2000) defines as follows: "a divide between what we know we must support socially and what we can support technically." The socio-technical gap has two dimensions: some of the social actions are not supported and some of the new functionalities that technology offers are not yet understood or socially acceptable in our social behaviour rules.

On the community level, one dilemma is that content consumption and creation are often not in balance in communities that are built on user-generated content. Most of the users are eager consumers of content and less willing to produce or especially share any content. In fact, studies have shown that consumption activities, such as browsing a friend's profile page, status updates or photos, account for the majority of all user activities on social networking services (SNS). Previously, there has been a massive amount of research on how to make users active participators in SNS, online communities and social media. In Web 2.0. services, active users were most important for the services, whereas in Web 3.0. services, passive users that mostly participate by consuming the content are equally important. In the novel services, users are participating and creating information by just consuming. Consumption activities can benefit other users when they are used as a means to order content by its popularity and to collaboratively filter the content (Dieberger, 1997; 2000).

Bentley et al. found striking similarities between the use of commercial and personally created content (Bentley et al., 2006), indicating that the perceived border between these two may be vanishing. Traditionally, there has been a strong division in PIM related studies between the commercial or professionally produced content and UGC, which is seen as content produced by amateurs. However, in the current UGC dominated world, the boundaries between these two are vanishing. Personal information management (PIM) and managing personal collections are widely studied areas. This work scopes managing personal collections out of the research focus.

2.4 Motivations and Needs in Content-Mediated Interaction

In UCD, needs are often referred to as *user needs,* traditionally referring to features that users want or need in the system. In contrast to that, on a more fundamental level, the needs are *human needs*. For example, in Maslow's (1943) hierarchy of needs, where the basic and physiological needs cover the bottom of the hierarchy preceded by the relatedness, esteem and actualization needs being on the top. Users' activities can be seen as the end results of *needs*. Fundamentally in content-mediated interaction, *safety needs* are low-level needs that come before *self-fulfilment needs,* meaning that users consider their privacy before sharing. Previous work on motivations suggest that higher level needs can overcome the more basic needs (Wahba & Bridwell, 1976). The upper levels of Maslow's hierarchy (1943) are reconsidered in the work by Ryan and Deci (2000) and Sheldon (2001). Additionally, Wiklund-Engblom and others (2009) have studied the relation of basic human needs and the user experience. Their work identifies six fundamental human needs that relate to the user experience of the products: autonomy, relatedness, competence, stimulation, influence and security. Also, Sheldon's work has identified the top candidate needs (2001) and Hassenzahl et al (2010) have developed a framework to further construct an UX theory on the top of these main needs. Weiser et al. (2015) have studied motivational affordances of gaming, and their work describes a taxonomy, which can be used in design.

There are multiple motivation theories that explain and predict the phenomenon of content sharing. Ryan and Deci introduced the self-determination theory (SDT), which sums up behavioral motivations under three main themes: autonomy, relatedness and competence. Users are fundamentally and universally motivated by being in control of their own life (autonomy), the connections and interactions with others (relatedness) and their own capabilities and developing them (competence). Motivations are intrinsic and/or extrinsic (Benabou & Tirole, 2006), meaning they either rise from inside the person, motivating the person to act because it is worthwhile doing something for the sake of itself, or for learning and for personal growth – from intrinsic, personal reasons. Extrinsic motivations on the other hand, rise from external and instrumental goals or prizes. Extrinsic motivations include the assumption that there will be an outer incentive for doing something. As the main motivator for storing personal photos and making private collections is stated to be for personal growth and identity-building (Olsson, 2009), which are highly intrinsic motivations. Also sharing the memories with others is essential. Social networking services can offer collective value to the content by facilitating sharing of the personal media, thus offering a sense of community. A sense of community is a concept that is widely studied and discussed in relation to online communities in the early 2000's. The concept itself was introduced in the 1980's by McMillan and Chavis (1986), who categorized the main components: feeling of membership, feeling of

influence, integration and fulfillment of needs and shared emotional connection. Blanchard et al. (2004) have studied sense of community in online communities.

George Homans's work (1958) introduces the social exchange theory (SET). Content sharing can be seen similarly as a social exchange process in which three parties are involved, the creator, the sharer and the individual or group of individuals to whom the content is shared. The three main types of social exchange are negotiated exchange, reciprocal exchange and generalized exchange. In the social exchange process, the sharer considers the costs and benefits of sharing. In online sharing, the sharer usually gains nothing in the process, but the receivers benefit. Online sharing is motivated by the expected emotional and social rewards. Emotional and social rewards are discussed in the work by Blau (1964). Blau listed rewards such as: reputation, social acknowledgement or recognition, approval and respect (Blau, 1964).

One of the modern theories explaining the motivations to use media and services is *uses and gratifications* (U&G). The uses and gratifications theory addresses why people use media products and what are the gratifications they receive or expect to receive from the use. Dholakia et al. (2004) presented five categories of U&G in SNS use. *Purposive value* can be *instrumental* gratifications, such as receiving information. *Self-discovery* includes gaining knowledge of self and social resources. *Maintaining interpersonal connectivity* includes keeping in touch with contacts and maintaining friendships. *Social enhancement* includes status and recognition. *Entertainment* includes fun and relaxation.

Different types of communities have a strong impact on the motivations to share. Altruism – giving something for the public good has been identified as a motivator in services like Wikipedia (Nov, 2013). Antin et al. studied technology-mediated contributions (Antin et al. 2012) with their main focus being on how the user-generated content-based services differ from knowledge-based services. Fugelstad et al. studied patterns of participation in Movielens (Fugelstad et al. 2012). Their work emphasized volunteering and pro-social behaviours as the main reasons to participate in Movielens. Bellotti et al. (2015) work listed motivations to participate in sharing economy related services. Their work presents a plethora of motivations besides just the instrumental motivations for sharing economy services. Epstein et al. (2015) have introduced a framework for sharing personal informatics. Epstein et al. (2015) see sharing personal informatics as a process, where "sharing triggers" is one of the affecting dimensions. Sharing triggers are conditions, under which the data is shared, for example from a request from the sharing audience.

Olson et al. (2005) conducted a cross-domain sharing study on the user's willingness to share different types of content. Their work focused on w*hat* information the user was willing to share and *with whom*, for example media, documents and personal statistics (for example health data, marital status) and also identified the clusters of target audiences that this

different type of information was intended for. Wiese (2011) adds that the "willingness to share" is also dependent on the frequency of collocation, communication and the overall closeness of the sharing participants. Prasad (2012) gives a controversial view on the domain of sharing activity data. Their work investigated that users were more willing to share some of the activity data to people that were not close to them than even to for example family members.

This work presents the identified six motivating factors in content-mediated interaction. The factors are *discovery, curating self, connectedness, collaboration, enjoyment* and *instrumental*. Motivating factors in CMI model gather *motivations* to participate CMI as larger themes. Motivating factors are by nature overlapping and activities in CMI usually involve varying mixtures of different motivations.

Discovery is an essential motivating factor, which especially relates to content consumption. Lehtiniemi has widely studied the act of discovering musical content and the related user experience (Lehtiniemi, 2014). The work of Lehtiniemi et al. presents different concepts for music discovery with examples such as outdoor multiplayer game applications (Lehtiniemi & Ojala, 2012) and adaptive avatars (Lehtiniemi & Ojala, 2014).

The motivating factor *curating self* consists of motivations of presenting and expressing oneself as well as developing self. Uski and Lampinen presented the concept of *profile work* (Uski & Lampinen, 2014), which suggests that people perform a significant amount of identity management online to create the identity they want online.

The motivating factor *connectedness* consists of motivations to communicate and interact with others through the content and also creating and maintaining relationships. The motivating factor *collaboration* includes motivations to perform activities together, contribute in a reciprocal way and an altruistic manner. An example of collaboration is creating collaborative mood picture playlists (Lehtiniemi & Ojala, 2013; Lehtiniemi et al., 2016) together for socially discovering new music content.

The motivating factor *enjoyment* consists highly of intrinsic and hedonic motivations, for example enjoying the content, sharing positive experiences and leisure activities. In contrast to that, *instrumental* motivating factors consist of extrinsic motivations, such as doing activities to gain income and outer incentives, such as gaining popularity or reputation.

Construction of these factors and how they were identified in this work, and how they relate to the previous literatureare presented in more depth in the results section in chapter 5.

3. Social User Experience

This section provides an overview on the user experience research relevant for the thesis. This chapter first describes the human factors that affect the experience. Second, it describes the notion of social context – consisting of the other users of the system and how they affect the use as an audience and the privacy perception of the user. Since content-mediated interaction and the related activities are social, the concept of the social user experience is based on the previous work, which is described as a theoretical foundation for this work. Finally, the chapter summarizes the research gap and gives a motivation for this research.

3.1 User Experience

Designing services in a way that they are easy, pleasurable and efficient to use is vital for the success of these services and applications. User-centered design (UCD), or human-centered design (HCD), is an approach that focuses on the users as the center of the design process from the start, widely involving users in the center of the process. This work aims to offer solutions that offer a better user experience as well as solutions for the mentioned problems.

Thesis sees the user experience as a concept that expands usability a pleasurable user experience needs practical, efficient and clear usability as a foundation. The user experience, however, consists of experiential qualities of the product on top of usability. The user experience is, by an ISO definition, "a person's perceptions and responses that result from the use or anticipated use of a product, system or service" (ISO 9241-210). Hassenzahl and Tractinsky define it as follows: "UX is a consequence of a user's internal state, the characteristics of designed system, - and the context – within which the interaction occurs" (Hassenzahl & Tractinsky, 2006). In the Hassenzahl and Tractinsky's definition, the social dimension of the user experience – the social context if you will - clearly falls into the "context within which the interaction occurs."

Hassenzahl and others' work (2000) has identified hedonic and ergonomic factors that contribute to the appeal of such software. Hassenzahl has identified factors such as functionality, content, presentation and interaction, which in combination create the basis for a pleasurable user experience. Forlizzi's work has also described the *elements* of the experience (Forlizzi & Ford, 2000; Forlizzi & Battarbee, 2004). Hassenzahl (2000) divides the quality attributes into pragmatic and hedonic. The pragmatic attributes include quality attributes such as clear, supportive, useful and controllable, whereas hedonic attributes include outstanding, impressive, exciting and interesting. In Hassenzahl and Tractinsky's model, three factors influence the user experience: system, user and the context of use (2006),

similarly found in Thuring and Mahlke's model (2007). The model by Mahlke and Thuring (Mahlke & Thuring, 2007, Thuring and Mahlke 2007, Mahlke, 2008) states that the user experience has three central components: the perception of instrumental quality, the perception of non-instrumental quality and emotions, which eventually lead to an overall evaluation of the usage. Instrumental quality traditionally denotes the importance of usability and effectiveness, pragmatic attributes. Non-instrumental quality and emotions concentrate on the subjective feel and experiential side of the product. Mahlke and Thuring clearly divide the elements that affect the user experience into three categories: *system, user* and the *context*. This thesis work uses similar high-level categorization on the *model of content-mediated interaction*.

3.2 Social Context

Traditional user experience (UX) research has focused mostly on the personal user experience of a product or a service. Context of use and how it affects the user experience is an important part of the UX research (Dey, 2001). Context of use is a central concept that affects the user experience of products. In HCI field of research, the context is often defined as a diverse environment in which the use of the device takes place (Jumisko-Pyykkö & Vainio, 2010). Korhonen, Arrasvuori and Väänänen-Vainio-Mattila (2010) defined eight categories of context that affect the use of products: environment, personal, task, social, spatio-temporal, device, service and access network. An important factor of the user experience in social applications and social networking services is the social context that the system is used in. Social context exists in many of the models defining context, but fundamentally, it has been merely a part of the context that affects the user experience. Jumisko-Pyykkö and Vainio (2010) note the "social context" saying it is formed by other people who affect the situation where device or product is used in. In this thesis, the social context is seen as the audience and connections that one is able to interact with through content-mediated interaction.

Hassenzahl and Tractinsky define UX as "a consequence of a user's internal state, the characteristics of designed system, - and the context – within which the interaction occurs" (Hassenzahl & Tractinsky, 2006). In Hassenzahl and Tractinsky's definition, social dimension clearly falls into the "context within which the interaction occurs." *The social user experience* has been introduced in the work by Väänänen-Vainio-Mattila and others (2010). The social user experience is built on the social context in which other users and their presence define the actual interaction. This work advances the knowledge of the social user experience. In this thesis work, the social context includes those that are *physically* present in the use situation. Social context importantly includes other users that are *virtually present* acting as

contacts and an audience in the system. Content-mediated interaction does not include face-to-face interaction, as explained in Figure 1.

Arguably, the social context of a service is partly out of the control of the designer. Only to some extent can the designer define the actions of its users, which ultimately create the social context to the services. However, the social context in an online service can only exist through the design choices and implementation. Design and technological implementation facilitates the interaction, whereas social context is one of the main contributors to the user experience. However, as the rise in the sharing economy services suggests, enabling activities with content in a well-designed technological platform can give birth to a global community around the phenomenon and start a new market.

3.3 Other Users as Social Context

People are willing to share personal content within their private circles such as with family and close friends, however limiting the sharing to these audiences can be problematic in SNS (Kairam et al., 2012). Personally captured content such as photos and videos are perceived highly intimate, but also objects worth sharing, and the "inner circle" sharing has become more popular (Kairam et al., 2012, Whittaker et al., 2008). *Circle of friends* is a concept of a limited and selected group of people within the service. This selection is made exclusively by the user. Small groups have needs for the technology that they would use for sharing with the limited group (Vyas et al., 2012). Close-knit groups have needs for demonstrating the group identity and for collectively managing content (Olsson, 2009). Sharing content to small groups, such as relatives, close friends or private groups is motivated by different reasons than sharing to larger audiences (Whittaker et al. 2008, Petrelli & Whittaker, 2010).

Frohlich and others (Frohlich et al., 2002) introduced the taxonomy of sharing the usage of photos, where time and presence are the most important factors, and these factors construct a framework of four types of photoware usage: asynchronous, synchronous, collocated and remote sharing. Kindberg et al. (2005) divide the sharing activities to be "functional," more pragmatic, task-oriented and "affective," which refers to sharing experiences and mementos. The term "storytelling" is telling about an event to those who were not present (Balabanovic et al., 2000; Miller & Edwards, 2007). Sharing mementos is termed collaborative remembering (Frohlich et al., 2002, Kirk et al., 2006, Sarvas & Frohlich, 2011). Work by Patel et al. (2009) gives insight to situations, which are referred to as "collocated-synchronous" sharing, where all the users are situated in the same location when taking and sharing photos. In the work of Salovaara et al. (2006), content sharing within small groups at special events was not considered only as an asynchronous activity, but rather as a sense-making and communicative activity that supports group interaction. Shared content gave cues

to organize the group within the event and included real-time interaction through photos and messages. In the thesis work, a similar phenomenon happened in the Social Camera use in **P1** when users communicated in real time through shared photos. Mainly the reason was communicating places to see and instructing others what they were doing in real time.

3.4 Reaching and Controlling the Audience

Content sharing requires a user effort in balancing between sharing and maintaining the boundaries of privacy. The explosion of online photo sharing services in the early 2000's changed researchers' focus to the privacy aspects of sharing. Ahern et al. identified new challenges that arouse around privacy issues: feedback, audience control and transparency (Ahern et al., 2007). Ahern et al. (2007) identified four factors that could affect people's privacy while sharing digital photos: security, identity, social disclosure and convenience. Self-representation and emotional aspects became important factors in digital personal content sharing (Van House, 2005). Goh et al. (2009) studied motivations of mobile content sharing, and due to the era, their main focus was on photo sharing. Their work presents motivation categories of sharing and social influence factors on sharing.

Olson et al. (2005) studied, in their cross-domain study, the users' willingness to share their content and information on different levels of intimacy. Their work presented a dataset and framework on willingness to share across different content types and to different groups. Sharma and Cosley (2015) suggest that users strongly personalize their content sharing based on the recipient. Belk (2010) presented the concepts "sharing in" and "sharing out." Belk's work compares habits of sharing "in" to the familiar audiences in order to maintain relationships and sharing "out" to reach new contacts and audiences. Broadcasting the content and disclosing one's content more broadly has become common with services such as Instagram.

Underestimating the size of the audience or the fact that they are not aware of who is able to see their content can prevent content sharing. Adjustments of privacy levels become an issue when content is shared through online systems. The concept of publics introduced by Lindtner et al. (2011) presents the imagined or perceived audience of the published content item. In this work, social context denotes the audience to the shared content. There is a fundamental difference in the imagined audience, the audience that the sharing is targeted to and in the actual audience that it reaches. Differences in the intended audience and the actualized audience can lead to user regrets of sharing (Wang et al., 2011). Goffman (1959) has presented the concept of self-presentation, which is a strategic pattern of presenting one's self to the public. Some aspects of self are concealed, and some are emphasized in order to present oneself in a wanted manner. Stutzum and Hartzog (2012) work on boundary

regulation in social media, and the term *profile work* by Uski and Lampinen (2014) brings self-presentation in an era of SNS's. In the current social media field, there is a wide spectrum of strategies to select how to present oneself. Sleeper et al. (2016) study how multiple services are used simultaneously as channels to share different types of content and to different types of audiences.

As previous studies suggest, managing the audience of the shared content is one of the key factors in the user experience. Users perform boundary regulations (Altman, 1975) to control who sees their content. Audience control includes both the "audience management" to prevent unwanted access or to limit sharing as well as "audience reaching" to reach the wanted audience in its entirety (Litt & Hargittai, 2016a; 2016b). This is important in the services, where other users are allowed to remix and otherwise reuse the shared content. Design can be personalized based on the different personality types. Nov et al. (2013) has studied designing different audience control options for extroverted people. They draw audience size manipulation options that match different personality types. The reuse of visual content, such as photos and videos, has been in the focus of Marshall and Shipman's (2011, 2013) work. Their work describes how users perceive the reuse of the content that they have shared by other users. The *imagined audience* means the audience that the content producer thinks they are sharing to or performing for. Marwick and boyd studied navigating imagined audiences in Twitter, and they describe an array of strategies that Twitter users perform (Marwick and boyd, 2010). Litt and Hargittai describe *audience-limiting* and *audience-reaching* as strategies to control the sharing spectrum of content in SNS (Litt, 2012, Litt & Hargittai, 2014; 2016a; 2016b).

In the previous literature, numerous factors that affect the threshold and privacy feel of sharing content have been identified. Xu et al. (2016) suggest that the short lifespan of the content and *ephemerality* can lower the threshold of sharing the content. Their work studies Snapchat and its design ideology that is based on a short lifespan of content. Automated sharing ostensibly lowers the effort, but on the other hand makes the users more cautious over their privacy. Vihavainen and others (2014) describe the effect of automation in content sharing to privacy perception. Their work suggests that while automated options require less effort from users, the downside is that the users may feel disempowered and unable to perform boundary regulation. In the era of asynchronous computer-mediated communication, users were able to express themselves in a carefully constructed manner (Vitak, 2012; Vitak, 2015). The context collapse of current online sharing makes it hard to control the audience. While current services enable interplay of different devices to share content, boundary regulations and audience management are lagging behind.

3.5 User Experience in Social Context – The Social User Experience

Social dimension in interactive products as a factor of the user experience, still remains a less-studied area. Battarbee has studied the social dimension of the user experience and defines that *Co-experience* denotes a user experience that includes experiencing together or the experiences, which are created together with the use of interactive technology (Battarbee and Koskinen, 2005). Buccini and Padovani describe the *social experience* as an experience that "happen(s) among individuals and are intermediated by products" (Buccini & Padovani, 2007, p. 502). Raita (2015) deepens the knowledge of the social dimension of the user experience stating that the user experience is "not mediated only by ICT use, but also by social processes." This thesis work emphasizes that content-mediated interaction online is by nature social, as is the related user experience. The major part of human-computer interaction online related to content eventually targets interactions between people, but still for some parts, activities require interaction with the system. The social user experience occurs in the computer-mediated and content-mediated interactions between people.

The social user experience is defined by Väänänen-Vainio-Mattila and others (2010) as a "user experience that primarily occurs as a result of social activity enabled by distinct service functionality." Väänänen-Vainio-Mattila et al. (2008) have identified dimensions of the Web service user experience and identified that support for social activity is one of the major elements of modern web services. The social user experience happens in a social context, where users and their presence define the actual interaction. Väänänen-Vainio-Mattila and others (Väänänen-Vainio-Mattila et al., 2010) define factors for the social user experience. *Curiosity, learning, self-expression, suitability of content and functionalities, completeness of networks* and *competition* were identified as the motivational drivers for the social user experience. In this work, the *social user experience* is built on the social context in which other users and their presence define the actual interaction. This thesis work defines the social user experience followingly:

> *A person's perceptions and responses from the use of a product, system and service, in which the emphasis of use includes other users of the system as a social context. The social user experience occurs in services and applications where other users are actively involved in the use of the system and which enables interaction between users utilizing the system functionality and shared content as a media.*

The definition of the social user experience expands on the models and theories that were presented on before by taking the social context that other users created as one of the major elements of the user experience. The contribution of this work is to understand how other users affect the social user experience as "secondary users," as an audience and as enrichers

of content. Where social context was seen in many previous HCI research as a momentary context and how others physically near affect the user experience, this work sees other users as an audience to the user's interactions, shared content and activities in the system and then secondarily as watchers, commentators, collaborators and content enrichers. In contrast, the definition of social context in the activity theory includes the large construct of context in which the relationship exists, for example, the entire history of other involved persons and the norms of the group (Vygotsky, 1978; Leontiev, 1978). However, the effect of the broader construct of social context to CMI is not in the focus of this work. This work focuses merely on the social context that is present through the service in content-mediated interaction. The definition of the user experience in this thesis includes not only the experience of using a device or product, but instead the whole experience of interaction with other users mediated by the service and the shared content.

3.6 The Research Gap

Novel types of sharing services enable new kinds of activities and interactions with the content. Content sharing has been in the focus of HCI studies since early 2000's. The studies have mostly focused on personal information management, privacy aspects of sharing personal content and the work-oriented collaboration with the content. Despite the amount of research on the content consumption, creation and sharing, there is an evident gap for a concept that summarizes the range of activities with the content. There is a need for a model that allows researchers to understand the underlying motivations and activities that apply to emerging and new types of content and compound content.

Since the majority of the activities that relate to online content are social, it is important to understand the social dimension of the related user experience and how the social context affects the content-mediated interaction. In the HCI related research, the user experience has been widely studied. This work focuses on how the social context affects the content-mediated interaction and the related user experience. This work uses the theoretical work of the social user experience and co-experience as a starting point. While the research field of CSCW specifically has traditionally focused on the cooperative use of work-oriented services, this work extends the knowledge towards more entertainment and leisure-oriented services, which still enable cooperation between users. Earlier works lack descriptions of the collaborative activities around content and the underlying motivations that drive these activities with the content. This work addresses the motivations and activities in content-mediated interaction. In earlier works, there is a lack of the notion of the social context: the audience and the collaborators and how they affect the user experience. This work addresses the socio-technical elements that affect content-mediated interaction. There has been a lot of

research on the motivations on sharing specific types of content, but extending the knowledge on the content in general is in the focus of this work. The model constructed and presented in this thesis describes the activities with the traditional and modern types of content-mediated interaction and the related user experience. The overarching motivation for the work is to draw together elements that affect content-mediated interaction and the related user experience. In the thesis, the model is reflected to other related existing models of user experience and interaction design.

This work offers a plethora of examples of the different activities that happen in the content-mediated interaction. The identified motivations to participate in content-mediated interaction and the related activities are drawn into the human-computer interaction level, explaining which kind of features support user activities and motivate users. Finally, the work gives practical contribution by presenting design implications that help designers to support content-mediated interaction in the applications and services. The presented model, as a theoretical lense, enables the evaluation and design of high-level concept ideas for new services from an activity design viewpoint.

4. Research Design and Case Studies

This chapter describes the overall research approach and methodological choices made in the research process. The chapter explains the ethical choices in the research, and the description of the case studies further explicates the methodological details as well as introduces the themes of the publications in this thesis.

4.1 Research Approach

The thesis belongs to the field of human-computer interaction (HCI), which is a subfield of computer science that focuses on designing easy to use, efficient and enjoyable interactive systems. More specifically, the perspective is on the user experience (UX). The main goal of the thesis is to understand the elements that contribute to content-mediated interaction and to the related user experience. The research aims to gain a deeper understanding of content-mediated interaction from the user experience viewpoint. The research is *exploratory* and *qualitative* by nature, and it aims to understand the studied phenomenon in depth. The focus is on the activities, motivations and experiences of a user. In contrast to the sociological approach where the phenomenon is approached from a community viewpoint, the focus in this work is on the social processes and interactions from a user's viewpoint.

The research adopts a *case study* approach, since most of the studies concentrate on a service, concept or a simulated concept and a selected group of users. A *case study* is a commonly used approach in the human-computer interaction field. Case studies study specific instances or a group of instances within a specific real-life context (Yin, 2003). Because the user experience is affected by the users, the system and the context in the content-mediated interaction, we selected the case study approach to explore the phenomenon holistically. The case study as an approach was selected, since it enables observing the certain phenomenon in a context that is not controlled by the investigator, but instead is a meaningful, real-life context in which an actual use of the system happens. It is a specifically effective method for building theories and hypotheses or providing evidence of certain behaviors or activities. We conducted six case studies, in order to understand the phenomenon of content-mediated interaction and the related user experience in different technological and social contexts.

Figure 2 presents the fields this research relates to.

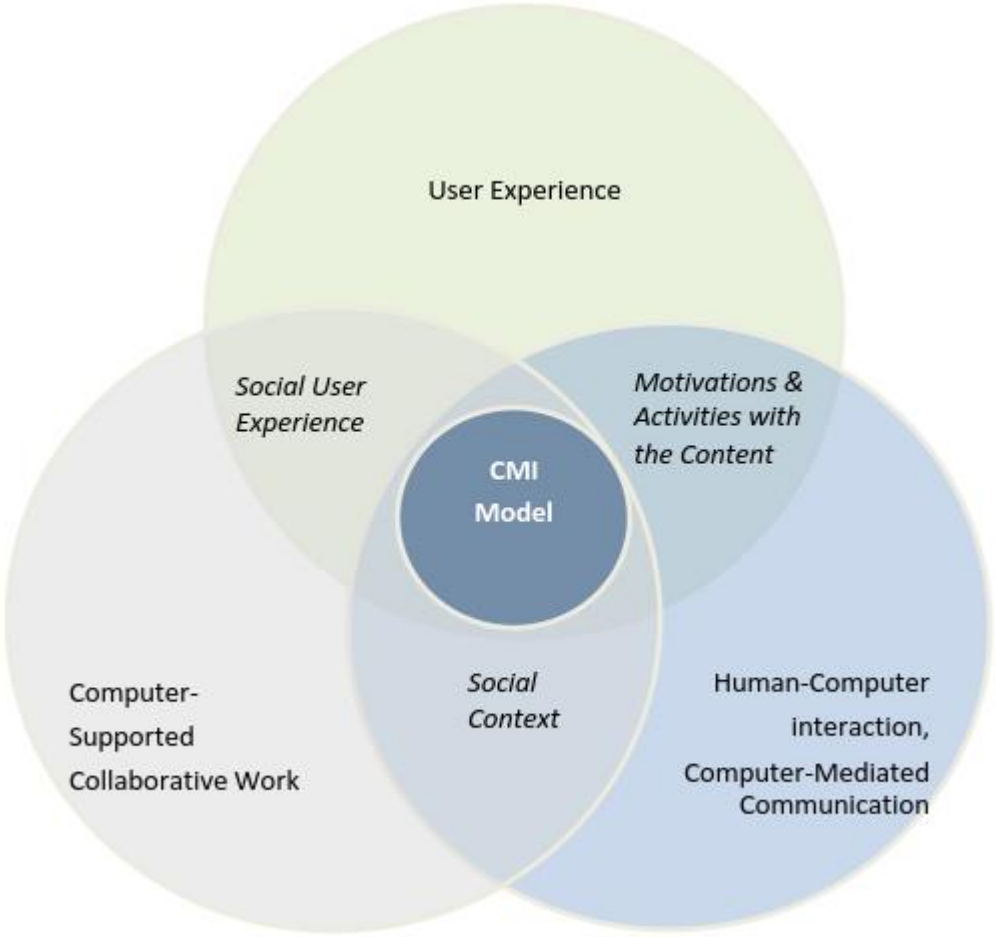

Figure 2. Research fields and positioning of the central concepts

Figure 2 describes how the model of CMI is positioned in relation to the research field of HCI. This work contributes to the research fields of HCI, CSCW and User Experience. The three main concepts of this work are the *social user experience*, the activities and motivations with content and the *social context* that are all drawn together in the CMI model.

4.2 Methodology

The publications **P1, P2, P3** and **P6** are carried out by using the case study approach (Yin et. Al., 2003) where the user's needs, practices and experiences are studied in different contexts and services. The selection of the qualitative research methods for the studies included user interviews, group interviews, observations and user experience evaluations. The selection of the qualitative methods aims for an in-depth understanding of the research case.

The research process consisted of case studies in **P1, P3** and **P6,** a simulation experiment in **P4**, and a combined field trial and simulation experiment in **P2**. These case studies and experiments reveal the activities of CMI and the related motivations. In the extensive online

survey in **P5**, the activities and motivations were validated and extended with the focus on the multiple emergent content types that people share.

Publications **P1-P3** adopted an observation of users while actually performing the activities with the system. Publications **P1** and **P6** adopted virtual ethnography (Lazar et al., 2010) or online ethnography (Hine, 2005). Simulation of the actual system use was performed in publications **P2** and **P4**. Case studies **P3** and **P6** adopted the design research approach (Laurel, 2003). Design research builds prototypes and concepts and then evaluates them, partly aiming for developing the design process itself. The design research approach is adopted in publications **P2, P3, P4** and **P5**. In these cases, either concepts or prototypes were used, tested and evaluated by users. Publication **P4** adopted the participatory design approach, where potential users of the systems were involved in the development in the early phase of the design process.

Case studies **P1, P2, P3** and **P4** were analysed using affinity diagrams (Holtzblatt et al., 2004). Case studies **P5** and **P6** were analysed using an electronic form of affinity diagrams. In the final phase, the different case findings were compared and a cross-case analysis was performed to construct the model. In the cross-case analysis phase, the recurring phenomena in different contexts and with different content types were identified (Table 3).

Publi-cation		Time of the Study and Location	Users (N)	Study Design	Data Gathering Methods	Analysis	Type of Shared Content in the Study
P1		Autumn 2009 Tampere, Finland	20	Field trial, case study	Diary, Virtual/online Ethnography, Interviews	Affinity diagrams, Grounded theory	Exercise data
P4		Autumn 2011 Tampere, Finland	16	Simulation	Interviews, UX questionnaire	Affinity diagrams, Grounded theory	Photos
P3		Spring 2012 Tampere, Finland	17	Field trial, case study	Diary, Interviews, UX questionnaire	Affinity diagrams, Grounded theory	Photos
P2		Autumn 2012 Tampere, Finland	30	Simulation study, content capturing events (N=15), case study	Field Observation, Interviews, UX questionnaire	Affinity diagrams, Grounded theory	Videos
P6		2012 Tampere, Finland	45	Field trial, Case study, Design research	Virtual/online Ethnography, Data logging interviews, UX questionnaire	Electronic affinity diagrams, Grounded theory	Music, Music playlists
P5		Spring 2015 Global	200	Online survey, Mixed methods	Online survey	Electronic affinity diagrams, Validation of the model	Emergent content types

Table 3. Overview of the studies in chronological order

The case studies gathered a rich set of empirical data contributing on the understanding of content-mediated interaction. The research scope was on the interactions around user-generated content. The case studies used a corroboration of multiple data gathering methods as Table 3 more specifically describes. The main empirical data gathering methods were *interviews, surveys, diaries* and *observation*. *Diaries* were used in the cases **P1** and **P3**. *Interviews* were used in all cases except in **P5**. Field trial with a service or application was used in **P1, P3** and **P6**. *Simulation* of a service with using paper prototypes or simulating the system actions by other means was done in **P2** and **P4**. *Observation* of users while they

performed activities with the system was a method in cases **P2, P4** and **P6**. The observations and qualitative findings were supported by quantitative data, such as usage logs in P6 and an investigated amount of the shared content in **P2, P4, P3** and **P6**.

4.3 Research Ethics

Since the research conducted in the cases did not compromise the participants' health and did not cause any mental stress to the participants, an external evaluation of the ethicality was not required. The research conducted in the thesis follows ethical guidelines of the Finnish research ethics authority: Finnish Advisory Board of Research Integrity (TENK). The guidelines of TENK list honesty, integrity and responsibility as the main values of research (TENK, 2012).

The research followed ethical rules of anonymity, the willingness of the participants to volunteer and storing the data. In each case study, the participants were explained who the research parties involved in conducting the research were and that their personal information is not revealed and that their responses are not linked to them personally. Participants signed a data consent form for each study, where it was explained that the content and data that they created during the trials was treated confidentially. Anonymity of the participants was secured by using participant codes when storing, analyzing and presenting the data. When the pictures were used in the publications or other materials, participants were personally contacted and explicitly asked to give their permission. Research was planned, conducted and reported by the scientific standards as well as the research data storing was completed by the same standards.

4.4 Summary of the Case Studies

This section describes the case studies we conducted. The methods, study design and most important findings are described in the following parts.

4.4.1 Case Study for P1: Personal Exercise Content Sharing

In this study, we conducted a qualitative case study focusing on the platforms for sharing personal exercise data. In total, the study included 20 users of three different online services for sharing personal exercise data. These services are Movescount (10 users), Sports Tracker (7) and Polar Personal Trainer (3). All these services allow users to record their exercises and curate a personal inventory of the training history and share their exercises wihin a community of the service users. Movescount users (N=10) were keeping a structured diary of their exercises and the trial service use for a week. All of the 20 participants were interviewed concerning their user experience of their service. A field trial of Movescount was organized to study the user motivations and to track their exercises and share it in such a community.

Findings revealed three important classes of motivations: the social needs in sporting communities, the different motivations that are affected in creating the exercise content to the services and sharing the exercise content to other users. Findings of the study suggest that users upload their exercise data to the services mostly for monitoring themselves, but they made the decision to share their exercises to gain feedback and peer support from others in the community.

In the study, we identified **activities that users performed with their recorded exercise data**. Interestingly, users were stating at the beginning of the trial that they were motivated to keep a training diary for themselves, but eventually got very interested in the attention from other users. For example, comparison to the activities that others share in the service, enrichment from others about their content, peer-support and instructions from others were some of the social interactions that motivated them to upload the exercises and share them in the services.

4.4.2 Case Study for P2: Collaborative Video Remix Creation in AVRS

The second publication describes a user evaluation case study on the automated creation of collaborative mobile video remixes. The study was an evaluation of an automatic video remix system concept, namely *AVRS* (Automatic Video Remixing System). The study involved 30 users, from which 15 users participated in the content capturing sessions. The content capturing sessions (N=15) were held in three different contexts: a sports event, a music concert and a doctoral dissertation. The selection of different context allowed us to see how the different context affects the content creation. The automatic and spontaneous group formation and content gathering of AVRS was simulated in the study. Users captured video content at the events with loaned test devices that were collected after the events. Their video content was further processed to a collaborative remix that was shown to them in the closing interview sessions. In the session, all the participants were interviewed, and they filled in UX questionnaires of the watched remixes.

Findings of the study describe the **motivations that users stated for capturing and sharing mobile video content**. The findings suggest that users were willing to capture and share their video content to be used in the remixes when they knew that they would get the automatically crafted remix video as an end result. Collaboratively created remixes were stated to raise the quality of user-captured videos. As the study setting was simulated and participants were invited to capture videos in the pre-defined events, the motivations they expressed in the interviews are rather speculative. Additionally, the publication gave **requirements for the interactions made at the different event contexts**. In the interviews of the study, users highly appreciated the idea of having a possibility to spontaneously form a video creation collective in the events that they were taking part in. They were more

interested in forming a group with familiar people, but participants also positively received the idea of forming bigger and more anonymous collectives with random strangers. Users saw the value of a collective effort of contributing the video clips to the automatically created remix, being a part of the video creating collective and seeing the collaboratively created remix as the end result. Users gave positive comments and ratings on the idea of contributing their captured video clips to the service.

4.4.3 Case Study for P3: Instant Photo Sharing through Social Camera

The third publication describes a field study of the *Social Camera* application, which enables instant photo sharing with a small group. The study investigated four small groups and their use of the application. Participant groups attended different kinds of events during the trial, where they captured and shared the photos. Participants filled in a diary of the Social Camera use over a trial period of 1-2 weeks. After the trial participants were interviewed, they filled in a UX questionnaire about the trial period.

In the interviews, participants emphasized the importance of the possibility of sharing the photos through the Social Camera application **instantly to the pre-defined group**. A shared folder was adopted by the users as a communication channel to the group. During the trials, different forms of photo-based communication and experience sharing occurred, partly because textual means to communicate intentionally were scoped out of the implementation of the application. Users performed ways of **instant and ephemeral sharing and communication through the shared photos in the study**. The results of the study revealed **six enablers of the instant photo sharing: sense of connectedness and social awareness, presentation and expression of self, lightweight and surprising interaction, collective photography, documentation of experiences as well as privacy and user control.** Enablers were further elaborated into the design implications in the results.

4.4.4 Case Study for P4: Simulation Experiment of Photo Content Enrichment

The fourth publication describes a case study that used simulated photo sharing and content enrichment with small groups. Three groups of four users (N=12) took part in the study with two phases. In the first phase of the study, they attended a content capturing event together. Participants were given instructions to take photos at the event and share them with the researchers. After the events, they took part in the simulation sessions, where their photos were added to a low-fidelity prototype that simulated a photo sharing application. They were using the prototype to comment on and enrich the photos, and all the groups were interviewed at the end of the session.

The findings suggest that users wanted to keep control over their own content even in the small group setting, but the possibility for others to **comment on and enrich the content**

was stated to be highly motivating. In the interviews, users stated that seeing other people's comments and **other feedback on the photos motivated them to leave a sign of their visit**. Similarly, the "snowball effect" of accruing metadata and other activity was identified in the earlier work by Olsson et al. (2009). Collaboratively experiencing the photos and commenting on them was stated to be a pleasant experience, which was also stated to add motivation for the participants to share the photo content in a targeted manner to the small groups. Findings on the **content enrichment** suggest that content that is **enriched by multiple users attracted more interest in the sessions**.

4.4.5 Study in the P5: Online Survey on the Emergent Content Types

The fifth publication presents an online survey on the practices and motivations of sharing novel types of content and the related positive and negative experiences. The survey collected a total of 200 responses from online content sharers. The online survey included six selected types of novel content: music preferences, travel plans, sports activities, apartments and vehicles, virtual items on online games and dietary preferences. The selection of the services was made based on the continuum of *communicative* and *distributive* logics of sharing (John, 2012). The selection of content types covers both ends of the continuum. Additionally, the selection covers personally sensitive and non-sensitive types of content.

Users' positive and negative experiences of content sharing were identified by following the modified critical incident technique in the survey (Flanagan, 1958). We linked the empirical data of the positive and negative experiences that the users reported to the identified motivational factors. The results describe different activities of content sharing in detail, describing what kinds of content types are shared and to which audiences. Motivating factors of content sharing are described in detail in relation to each content type.

Findings of the study suggest that the **majority of the motivating factors occur regardless of the type of shared content**. The study **identifies six motivating factors** that occurred in different types of content sharing. Motivating factors in different content types were then compared. There were differences in the occurrence of the motivating factors between different content types, which suggests that systematic comparisons between content types would offer a promising area for further research.

4.4.6 Case Study for P6: Evaluation of the Socially Augmented Music Discovery in MoodPic

The sixth publication describes a two-phased user evaluation case study on a *MoodPic* concept. MoodPic enables users to share music playlists with a descriptive mood picture and a collaborative enrichment of the playlists. The concept is previously presented in work by Lehtiniemi and Ojala (2013) and the visual design of the mood pictures was extensively studied in Lehtiniemi and other's work (2016). Both phases of the study had 30 participants,

of which 15 were attending both phases of the study (N=45 individual participants). The *MoodPic* prototype was improved based on the first round of field trial evaluations, and it was iteratively evaluated in the second field trial. The publication describes the user evaluation findings and a set of social usage patterns that emerged from the use of the system. The concept was found to be motivating, and it was stated to support discovering new music through social interaction.

Results describe the **content that the users created during the trials,** and a total of **16 social usage patterns were identified in the use of system**. The user generated content consisted of playlists with a cover *mood picture* and the added songs. These playlists formed collaborative entities, in which other users were able to contribute to by adding songs. During the trial, the collaborative playlists were used as a communication channel, for example, to show the author of a playlist that you had listened to it by adding a selected song to the playlist. Partly, the song additions were used as a channel to communicate to other users. The social usage patterns described activities that users performed in relation to the content with the service. The findings suggest that collaboratively creating playlists and the social discovery of new music were appreciated by the participants.

5. Results

This research addresses three research questions. **RQ1:** What are the external elements that contribute to the content-mediated interaction? **RQ2:** What are the activities and motivations in the content-mediated interaction? **RQ3:** What kind of design solutions support participation in content mediated interaction? The first two research questions will be addressed in this chapter, Chapter 5, and research question 3 is addressed in Chapter 6 by drawing practical design implications from the case study findings.

As presented in the introduction of the thesis, the research tackles three problems that relate to the design of the systems: the socio-technical gap between what users are able to do in the services and the expectations and social norms; an imbalance between the amount of content creation and consumption still exist in the online services where most of the users are merely consumers of the content created by others. There is a contradiction between users wanting to keep the feel of control of their privacy over their content and at the same time, wanting to publish and share the content freely.

To address the research questions and the identified problems, five case studies and an online survey were conducted. Findings from these five case studies and the online survey were first thematically analysed case by case. In the further analysis, the recurring themes were induced as a model of content-mediated interaction, which is described in the following section.

5.1 Elements of Content-Mediated Interaction: The Overview

Shared content enables social user experiences, especially when experiences are communicated and shared through content in the online realm. Content-mediated interaction happens between people as *users*, mediated by the *content* shared in a technological *system and* where *other users* form the social context. There are four elements in the model: the *activity,* the *user, the system and the other users as social context*.

The primary focus of the model is to support the design and re-design of CMI services and experiences. Secondarily, it gives a basis for researchers to build evaluation questionnaires and extend on the theoretical work of the social user experience and content-mediated interaction. The *content-mediated interaction* (CMI) model is aimed at both the academic researchers and practitioners. It offers tools for understanding and analyzing user experiences related to activities with content, which is enabling further research in the CMI field. For

designers, it offers a theoretical tool for concept building and designing solutions that support content-mediated interaction.

The CMI model is synthesized from the findings in the case studies presented in Chapter 4. Each one of the case studies gathered findings on the motivations to participate in the content-mediated interaction. Users reported about the features in the prototypes and the services that were either facilitating, supporting, or preventing the interactions in their activities. Additionally, in each one of the case studies, experiences that occurred were reported by the users or were observed. We listed motivations and experiences as notes and thematically ordered them through bottom-up analysis, following the affinity diagramming method (Holtzblatt et al. 2004). Figure 3 represents the research process and analysis of the case studies.

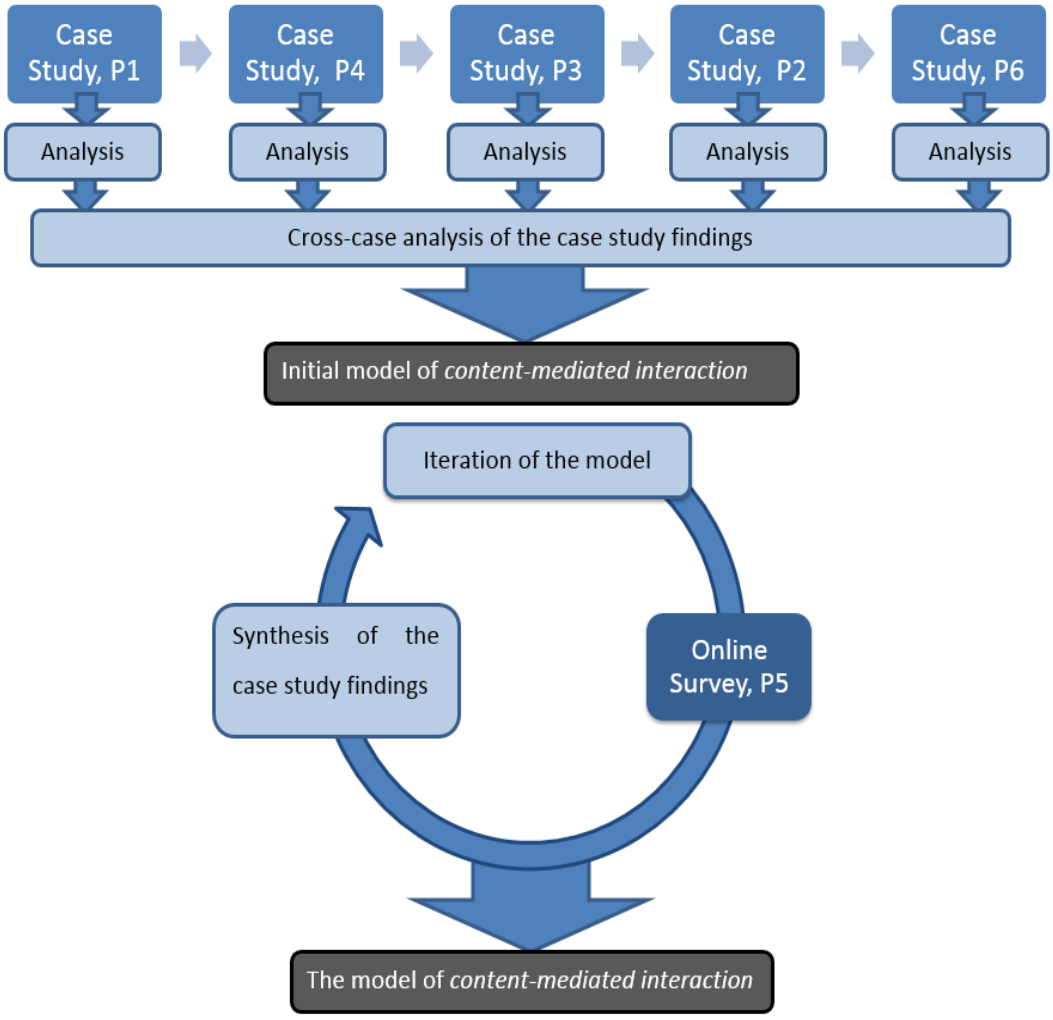

Figure 3: The research process and analysis of the case study findings

The model has been built by synthesizing the findings from the case studies through cross-case analysis and synthesis. The focus being on the activities, the motivations and the user experience that the users reported in the cases with different types of content. First, the case study findings from each of the studies was analysed using the bottom-up approach, thematically ordering the reported experiences and activities with the content. The empirical data from each study is a thematically ordered data set including user quotes and observation notes. A cross-case analysis was conducted by combining this thematically ordered empirical data from the case studies **P1-P4** and **P6** and also by thematically ordering the findings into 87 *initial finding themes*. These 87 initial themes formed the initial model of CMI. In the following iteration, findings from the online survey in **P5** were added to these classes, which were then iterated, restructured, and combined to be 53 *finding themes*. Following the grounded theory methodology (Glaser & Strauss, 2004; Strauss & Corbin, 1994; 1998), these classes were categorized into 18 sub-categories, which form the four elements in the CMI model (Table 4).

Initial finding themes (87)	15	53	12	7
Finding themes (53)	5	37	7	4
Sub-categories (18)	5	6	3	4
	Element 1: The CMI activities	**Element 2: Users and the motivating factors**	**Element 3: The System**	**Element 4: Other users as social context**

Table 4: An overview of the cross-case analysis process

Sub-categories are presented under the element descriptions in the following sections; for example, in Element 2 there are six motivating factors. Examples of *themes* can be found in the motivating factors in section 5.3., where the identified motivations are presented as *themes* under the motivating factors (which are the *sub-categories* in table 4). They present an example of the *finding themes* level data from the presented analytical process. Figure 4 gives an overview of the overarching elements and their relations in CMI. The model has similarities with Mahlke's model on higher-level elements. Where Mahlke presented three components that affect the interaction characteristics (system, user, context), CMI has four elements: *activities, user motivations, system* and *other users as social context* (Figure 4).

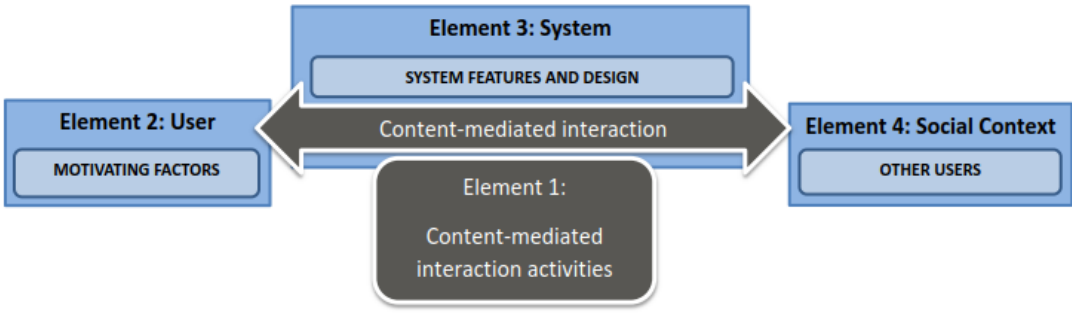

Figure 4. An overview of the resulting model for content-mediated interaction including the four main elements: activities, the user, the system and other users as a social context.

Figure 4 presents an overview of the elements in content-mediated interaction. The model has four main elements, which are *activities, user motivations*, *the system* and *other users as social context.* The figure shows the resulting user experience from the CMI activities and the four main elements affecting the user experience. Detailed findings and design implications will be presented in the following sections under each one of the elements. First, *activities* describe the activities related to content. The *user motivations* element consists of motivations to participate in the CMI, categorized under motivating factors. The *system* element consists of identified, desirable features that support CMI as well as the system and content properties that affect its use. The *other users as social context* element describes how the other users of the system are forming the social context, being the audience and making connections in the system as well as how they act as content creators and collaborators. The user's perception of the audience to the shared content is important and affects the user experience.

The process of interacting with the content itself includes three kinds of interactions (as described in Figure 1): 1) direct interactions between the users, 2) interaction with the system itself or its user interface, 3) content-mediated interactions between the users mediated by the content in the system, which is visualized in Figure 4 as the content-mediated interaction arrow.

Direct interactions happen when people interact directly without the help of the system. For example, in the case study of **P3,** the users met each other and discussed about their shared pictures in the Social Camera. Shared content evoked a direct interaction that was also related to the content. *Interactions with the system* include actual usage of the system as in the traditional HCI. For example, in **P2,** the users stated that recording videos on a sports event needed concentration and affected how they perceived the event itself. In this activity, the usability and interaction design supported the pleasurable use of the system. Finally, *content-mediated interaction* is interaction between people, mediated and facilitated by the *content* shared in the *system*. It is human-to-human interaction mediated by technology, more

specifically the shared content. For example, in **P6** users communicated through the collaboratively created playlists. These shared playlists facilitated interaction, but they also formed a social user experience. In **P2** the users felt that their content became part of the video remix that was created together, allowing them to feel that they were a part of the group experience at the event but also producing the outcome product of the event in the form of a video remix. Content-mediated interaction can be synchronous or asynchronous. Conceptually, the users interact with each other with *mediation* by the system.

The model concentrates on the activities from a single user's point of view. However, the social context point of view is included in the *other users as social context* element. *Other users as social context* element presents how the audience and the community of the content affect the user experience.

5.2 Element 1: Content-Mediated Interaction Activities

Activities are defined as high-level goals, to which users aim at by performing tasks through interactions on the user-interface level (Rosson and Carroll, 2002). Human activities are driven by needs and motivations. Activities are mediated by tools and are performed by actions (Vygotsky, 1978; Leontiev, 1978) or interactions on the system-level (Kuutti, 1995). Affordances and features of the service or system offer either help or prevent users in these activities (Rosson & Carroll, 2002). Activity design aims at designing functionalities that offer help in reaching goals and objectives, where interaction design concentrates on the level of manifesting the interactions on the user interface level (Preece et al., 2015; Sundar, 2008; Rosson & Carroll, 2002). Understanding the activities supports a high-level design of services that enable CMI. This work's contribution is on the activity design level.

Shared content can create social user experiences, but it also mediates experiences and communication between people. This work identifies five activities in content-mediated interaction: *content creation, content sharing, content enrichment, following the content* and *content consumption* (Figure 5).

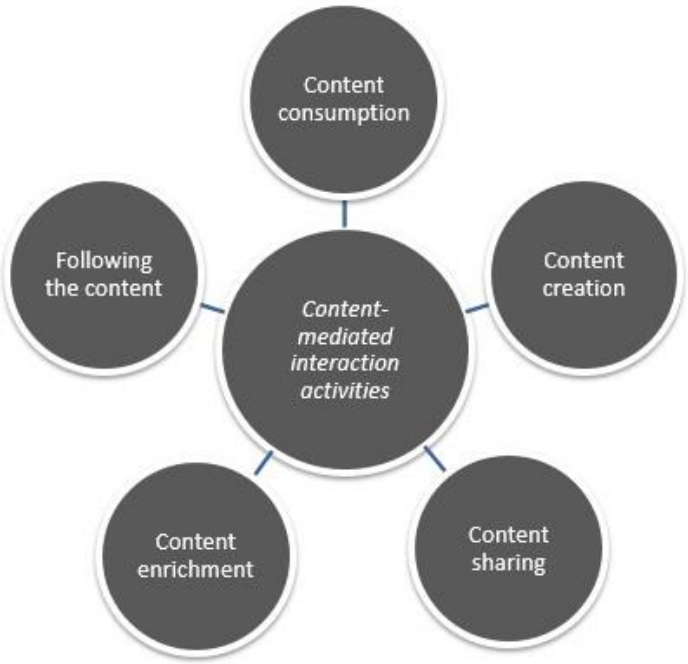

Figure 5: Content-mediated interaction activities

Consumption, creation and *sharing* are activities that are also covered in earlier research. Lehikoinen et al. (2007) describe four stages of experiencing the content: get, enjoy, maintain and share. If we compare the activities to the GEMS model by Lehikoinen et al. (2007), we will see that in their content lifecycle model, the phase "get" includes content collecting, downloading and purchasing, whereas the phase "get" does not explicitly describe the content creation. In the thesis research, this was found to be an essential part of the activities. This was partly because of the developed content capturing and creation capabilities of mobile devices. Also, PIM studies have focused on creating and maintaining personal collections of data, which was not focused on in this work. The following sections describe each of these five CMI activities one by one.

Traditional user experience research and design mostly approaches content sharing from a single user viewpoint, where the focus is mostly on *content sharing* and *content consumption*. This work also describes activities of *content creation*, *content enrichment* and *following content,* which are novel findings that this work contributes to the knowledge on activities with content. These different activities of content-mediated interaction can happen in any order.

5.2.1 Content Consumption

Content consumption describes any content consuming actions that users perform, for example following others' photos appearing on Facebook or reading Tweets on Twitter. For

content consumption, the features that support *content discovery* are essentially online, and users are not only dealing with the content created by themselves, but also the mass of content created by others. Hence, users face problems in finding relevant content from the ever-growing inventories. Lehtiniemi has studied discovery widely, especially focusing on the design features that enable music discovery (Lehtiniemi, 2014).

Research has shown that consuming or browsing accounts for 92% of all user activities (Jiang et al., 2010, Benevenuto et al., 2010) in these services. Latent users are dominant in some of the UGC based communities (Velasquez et al., 2010). An important design approach is to utilize content consumption as a way to contribute and create (Vyas et al., 2012). Means for utilizing content consumption to produce data are through collaborative filtering and community-based content discovery. Examples of that would be Twitter and FB "trending" features or "related videos" on YouTube, which use consumption data to collaboratively filter the content.

5.2.2 Content Creation

Content creation activity includes content capturing, downloading and purchasing. Additionally, editing the content and preparing the content for sharing are included in the content *creation activities*. In the simplest form, creation is shooting and editing a photo or video on the user's mobile device. In the current online realm, the threshold for content creation has become low, and many users are actively creating content.

Studies in the early 2000's emphasized the meaning of content contributors on online services and the imbalance of the consumers and creators; for example, Preece and Maloney-Krichmar (2002) termed passive users as "lurkers." Lindley et al. (2013) took a new viewpoint to the PIM in their work, where they describe how SNS and social media are used as personal content repositories. There are different levels on how users generate the content. The content can be solely produced by the author or can include some parts from other users, or it can be fully remixed or reused from the content of others. It can be socially produced or *enriched* – see the following sections for a more detailed description.

5.2.3 Content Sharing

Content sharing activity includes uploading content to the service or application where it will be ultimately shared, for example sharing your recorded exercise on Endomondo. Content sharing is the most widely studied activity in CMI. John (2012) emphasizes that the term *sharing* is generally used to constitute participation in Web 2.0. services. On the contrary, CMI sees *sharing* merely as one of the activities of participation. *Sharing* as a term can be divided into *communicative* and *distributive* logics of sharing, depending on if the shared object is limited or not (John, 2013). Content sharing usually has a certain *threshold of sharing,* as there is a certain amount of work needed before sharing the content. Kirk et al.

(2006, 2007) have investigated this problem in their work on photowork and videowork, which describes the bottlenecks of sharing. When the content is shared online, it becomes mutually owned. Olsson (2009) terms *collective content* as "digital media content that is regarded as commonly owned as well as jointly created and used" (Olsson, 2009). In contrast to Olsson's definition of collective content, in this work, the shared content may not be commonly or collectively owned – original users can have the possession of the content. Digital content that is partially or entirely user-generated and shared with other people are able to either enrich or contribute to the content – as explained in the content-mediated interaction activities and is termed *enriching content*. When other users interact with the content, it becomes *socially enriched content***.**

Frohlich (Frohlich et al., 2002) has introduced a model of four categories in the use of photoware: co-present sharing, remote sharing, archiving and sending. These activities relate to the activities of *content sharing*, *creation and collecting* in *CMI.* Sharing the content is a decision that the user makes after considering the privacy options versus the expected outcomes of sharing. User decisions on sharing requires balancing between autonomy, privacy and keeping control over one's content, and then on the other hand the motivations to share. Motivations to share are described in the results section of the thesis.

5.2.4 Content Enrichment

Content enrichment activity happens in collaboration with other users. Commenting, re-posting, re-sharing or remixing the content can be seen as *enrichment* where content develops and can even form new *content entities,* for example YouTube videos enriched with discussions in the comments or related response videos. Another example could be a situation where your Facebook friends comment and re-share your photo on Facebook. Naaman et al. (2010) have identified *informers* in Twitter sharing and re-tweeting information, which is an example of content enrichment and re-sharing content.

Multiple users are able to collaboratively produce the content and enrich it socially, resulting in new content entities. When content is *shared* with another person or group of people either through an online service or through physical means, it becomes social. As defined earlier, *socially enriched content* is shared digital content that is partially or entirely user-generated and shared with other people, who are able to either enrich or contribute to the content. Socially enriched content can be a remix of user-generated content, such as items with related annotations, comments, and metadata that the particular service enables users to form.

Accruing the social metadata over shared content is a phenomenon originally introduced by Odom (2011). In content enrichment, it means there are remixes of the content, comments that accrue over shared content and re-shares of the content. In *social enrichment* activity,

content creates a new *entity* with all the added or *accrued* social data. Collaborative content enrichment also supports engagement with the content when even the users that have not produced the content but enriched it with a comment, a rating or a re-share become emotionally engaged in the content. Different interactions and collaborations around shared content can make a group of users mutual owners of the content.

Reusing and remixing different types of content has been studied by Marshall and Shipman (2011), and their work discusses how the boundaries of ownership feel and the regulatory and copyright dimensions that occur in the content reuse.

5.2.5 Following Content

Following content is an activity where after users share or publish content, they then want to follow how others consume the content. For example, after sharing your exercise on Endomondo, you follow how many visitors and followers it collects, or after sharing a playlist you made in Spotify, you follow its popularity. Popularity of one's content, visitors on the content and their experiences, comments and ratings are all essential. Social awareness features such as "who has seen this picture," "visitor counter," ratings and re-shares can support this phase of the content interaction cycle. Being aware and able to follow the shared content is one of the main motivators. Following the content is an activity that leans toward consumption. Furthermore, following the content endorses the users' self-expression, self-actualization and enables them to follow their popularity and understand their status in the community. Features allowing user to follow content and be socially aware of others are motivators to share content, as the case study findings suggest

5.2.6 Content-Mediated Activities in the Case Studies

Findings in **P1** revealed three important classes of motivations: social needs in sporting communities, different motivations that affect creating the exercise content in the services and sharing the exercise content to other users. In the CMI activities, the findings in **P1** contribute to the *creation, sharing* and *consuming*. Findings of the study suggest that users uploaded their exercise data to the services mostly for monitoring themselves, but they made the decision to share their exercises to gain feedback and peer support from others in the community. Thus, the identified activities also contribute to *following* the content.

In **P2**, *creation* and *sharing* were in the focus of the AVRS study, but findings revealed that also the *enrichment* and *following* of content was related to how users perceived their own content as a part of the collaboratively created remix. In **P3**, participants were using Social Camera as an instant communication channel for both *consuming* others content and *sharing* their own content. Additionally, *following* their own content and instantly seeing the reactions of others was interesting. In the findings of the study for **P4**, it was identified that the possibilities for others to comment and enrich the content was stated to be highly

motivating. CMI activity *enrichment* was central in this study. In the interviews, users stated that seeing other people's comments on the photos motivated them to also leave a sign of their visit. In **P4** findings on the content *enrichment* suggest that content that is enriched by multiple users attracted more interest in the sessions.

P5 focused on the sharing; however, there were additional findings on the other CMI activities. The implementation of MoodPic in **P6** supports content-mediated interaction especially in *consuming* and discovering new music, in *following the content* in a form of following the popularity and in developing one's initiated playlists as well as the *enrichment of content* as users were able to contribute to the playlists of other users.

Table 5 shows examples of activities and social user experiences that were observed in the studies. These activities and social user experiences are presented from each one of the five CMI activities.

Content-mediated interaction activity	**Study**	**Example of user activity from the studies**	**Example of social experiences related to the activity identified from the studies**
Content creation	**P1**	Users recorded their exercise data to follow their development.	Users uploaded their exercises to a service to be able to *compare* it to others' exercises.
	P3	Users captured videos in the events in order to create a collaborative video together with the help of offered technology.	Users formed a spontaneous group in an event. Creating a multi-camera video collaboratively, and *being part of the collective* was appreciated.
	P5	Users created playlists to share their favourite songs with a picture related to it.	*Sharing an experience* to others through a meaningful song on a shared playlist.
Content sharing	**P1**	Sharing exercise data to the service in order to monitor oneself.	*Monitoring* and recording one's *self-development* to the service was a starting point. Through sharing the data, users collected feedback and *gained peer-support* from other users.
	P2	Adding photos to the group folder instantly from an event.	*Instant sharing* of experiences to the small interest group through the folder in the service.
	P6	Sharing playlists to show the user's favourite music and listening habits.	*Getting to know other users* through their playlist content added possibilities to connect with others and to share directed content. *Gaining new contacts.*
Content enrichment	**P4**	Commenting on shared photos as a group.	Accruing social metadata creates a *shared story* through the pictures from a shared event.
	P6	Adding songs to other users' playlists.	*Reciprocally discovering* new music through *collaboration* on the playlists.
	P1 & P5	Leaving comments on other users' exercise content to increase activity in the community.	*Contributing* to others' content to *support* an active atmosphere in the service.
Following the content	**P6**	Following other users' additions on my shared playlist.	The initiated content generating new collaborative playlists. The *Experience of creating together*.
	P1	Seeing the activity and feedback from others on my shared exercise.	*Following the popularity* of my content and experiencing the *social recognition*.
	P5	Sharing travel plans to see how popular they get.	*Following the comments* and times the travel plan content was read by other users. *Social recognition.*
Content consumption	**P6**	Seeing added songs from many users in the playlists widen the range of discovering new music.	Collaboratively created playlists developed positive inconsistency and variety. *Socially discovering* new ideas and content by seeing various viewpoints.
	P2	Watching the remix in which users contributed their content to.	Seeing the end product of the automated and collaborative effort. Seeing the event from another's point of view. *Storytelling* and *sharing experiences*.
	P3	Instantly discovering the photos of others in the shared Social Camera folder.	Seeing the activities others do in real time by the help of the application was highly appreciated. *Social awareness.*

Table 5: Examples of the five activities in content-mediated interaction and related social experiences.

The following section describes the identified motivating factors and reflects upon them with the five activities of CMI.

5.3 Element 2: The User and the Motivating Factors

The second element, the user, refers to the person who *interacts* with the system and one's motivations to participate in CMI. Motivating factors drive the choice to use the system, and the user experience can be seen as an expected outcome of the CMI with the system. Motivations guide and initiate the user's activities. The motivations are seen as abstract-level goals that the user aims for with lower level interactions. The *motivations* of use define if the user will consume or share content in the system.

Motivating factors in CMI model gather *motivations* to participate CMI as larger themes: the are higher categories that consist of *motivations*. Motivations in this thesis are seen as motives to perform the activities in CMI and to gain expected outcomes through these activities. An example of these expected outcomes can be the experience of *connectedness* through sharing content that is of interest to other users. In this case example, *connectedness* is the motivating factor to perform the activity, which in this case is *content sharing*. Similarly, in this case, the experience of connectedness is the expected outcome of the performed activity. Motivating factors thus can be seen partly as experiences that users expect from the use or the activities. Motivating factors affect the user's choice to make the private content public in the content sharing activity or to participate in different activities of CMI.

Different user characteristics that affect the outcome user experience have been summarized in numerous earlier works. Work by Väätäjä (2014) related to mobile journalism identified user characteristics as: *professionalism, the motivation for use, professional identity, prior experiences, expertise in photography* and the *personality*. Instead of focusing on the background of the user, the work focuses on the general motivating factors to participate in the CMI.

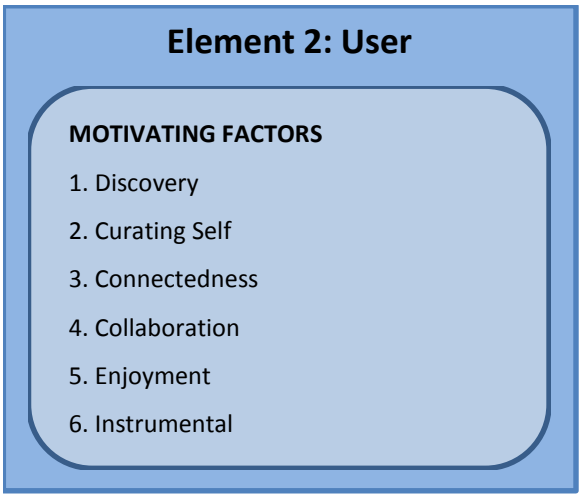

Figure 6: User element of CMI

The CMI model element of user in Figure 6 presents the motivating factors that drive user actions and participation in CMI.

The following section presents the six motivating factors presented in Figure 6. *Motivating factors* are upper categories of *motivations*. Motivations to participate in the CMI were elaborated upon from the case studies **P1, P2, P3, P4, P5** and **P6,** and then they were further condensed in to the *motivating factors* through bottom up analysis, as explained in the section 5.1

Motivating factors describe both the motives to use the service and the expected outcomes of the use. Outcomes can be instrumental, for example gaining information or income or emotional outcomes, such as gaining feelings of relatedness, connectedness or a sense of community. Motivating factors are by nature overlapping and interdependent. Activities in CMI usually involve varying mixtures of different motivations. In total, six motivating factors were identified from the studies: discovery, curating self, connectedness, collaboration, enjoyment and instrumental. The first five factors are mainly hedonic *be-goals* as described by Hassenzahl (2003) whereas the sixth category is a pragmatic *do-goal*. The fourth factor *collaboration* is partly pragmatic and partly hedonic. The six *motivating factors* are constructed from the bottom-up analysis on the gathered empirical data, and they are based on the previous work of motivations (Ryan & Deci, 2000; Maslow, 1943; Sheldon, 2001). Sheldon's work has identified the top candidate needs (2001), and Hassenzahl et al. (2010) have developed a framework of the top needs.

Motivating factors consist of thematically ordered motivations. The motivations were ordered under the presented motivating factors in the synthesis of the model. The motivating factors are explained through the CMI activities that were evident in the case studies. These activities were observed in the studies, and they are drawn from the empirical data from the user interviews and surveys in the case studies.

Motivating Factor 1: Discovery

Consumption is the activity that the users mostly engage in with the CMI systems. As the results from the studies show, users were highly motivated in finding content from others, especially their friends and colleagues. *Discovery* factor consist of motivations to find new and interesting content and learning new things through content. Easy access to the newest, most relevant and most interesting content as well as recommendation algorithms and offering the correct, targeted content are features that support *discovery*. In Karnik et al. work (2013), users who joined the specialized music group were motivated by discovering new things, making contributions and having social interaction. Discovering new things motivated them to reciprocally be social and contribute content to others. Lehtiniemi (2014) has studied music discovery applications and the related user experience extensively, concentrating on the experience of discovering new music through different concepts, for example, Adaptive avatars (Lehtiniemi & Ojala, 2012) and Mood Pictures (Lehtiniemi et al., 2016).

The motivating factor *discovery* links to *pleasure-stimulation and competence-effectance* found in the Hassenzahl et al. framework (2010). In the case studies, the *discovery* factor was evidently present in **P6**, where users were motivated to create and share their own playlists to give others the possibility to collaboratively add songs to it, enabling them to *discover* new songs. In **P5** participants stated that discovering and consuming content is one of the most important factors of deciding which service to use.

From the case studies, *discovery* as a motivating factor was identified in different CMI activities. In **P6** discovering new and interesting songs was stated to be an activity that relates to *content consumption*. In **P5** discovering new audiences for the shared content was *sharing* a related activity. *Content enrichment* was evident in **P6 in** the activity of discovering new music from the additions from other users to the playlists. In **P1** discovering one's popularity in the exercise community was identified in relation to following content.

In the synthesis of the case studies, following motivation themes were identified and constructed as the motivating factor *discovery*.

- Learning: In **P1** users stated that it was motivating to learn from the exercises shared by others.
- Discovering technical possibilities: In **P5** participants stated that discovering the possibilities of content recommendation algorithms in content sharing services is a feature that motivates CMI.
- Discovering one's skills: In **P2** discovering one's skills as a mobile video shooter was stated to be *content creation* related activity.
- Social discovery: In **P6** users emphasized the importance of socially discovering new music through collaborative playlists.

- Discovering new contacts and people: In **P5** users stated that discovering people that are interested in similar content is motivating.
- Curiosity: In **P3** the curiosity of following others' content in real time was stated to be motivating.

Factor 2: Curating Self

Motivations in this category are highly intrinsic. The factor *curating self* consists of a) self-expression and b) self-presentation. These two categories denote expressing and sharing things about actual self and presenting a favorable or wanted image of self to the imagined audience (Litt & Hargittai, 2015). Self-presentation denotes presenting oneself to multiple audiences in a preferable way (Odom 2011, Lindtner, 2011). Social media is a platform for exhibiting one's online identity (Hogan, 2010). Maintaining and modifying the identity online requires *profile-work* (Uski & Lampinen, 2014). One of the most important activities in the *curating self*-category is the personal memory and monitoring self, which was also identified in the work by Goh et al. (2009). Elsden et al. (2015) have studied quantified past and how users become emotionally attached to their personal inventory accumulated over time in services that enable tracking activities.

Ryan and Deci introduced the self-determination theory (SDT), which condenses behavioural motivations under three main themes: autonomy, relatedness and competence. In relation to the SDT, the curating *self* motivating factor reflects on autonomy and competence. In Hassenzahl's needs model (2010), *curating self* connects to *autonomy-independence, self-esteem-self-respect* and to *self-actualization-meaning.* Self-expression is an individual and intrinsic need, but it exists only in a social context – self-expression and presentation happen to an audience or imagined audience (Goffman, 1959). Extrinsic outcomes can relate to self-expression and self-presentation.

From the case studies, the motivating factor *curating self* was found in different content-mediated interaction activities. For CMI activity c*onsumption in* **P5** users stated that telling about their music taste and personality through shared music preferences was motivating. In **P3** *creation* activity was identified when users stated that taking photos of things and places that tell about them is motivating. In **P1** the *sharing* activity was present when users wanted to show their achievements through shared exercises. Work by Elsden et al (2015) similarly sums the importance of storing personal inventory, or"quantified past" as a reason that motivates users to capture and share. The *Enrichment* activity occurred in **P6**, where adding one's favourite songs to another user's playlist was a motivating activity. Following one's own playlist developed by others' recommendations was a motivating activity of *following,* which was displayed in **P6**:

In the synthesis of the case studies, following motivation themes were identified and constructed as the motivating factor *curating self*:

- Creativity: In **P6** participants were motivated to create their own playlists and the related mood pictures to share their creativity.
- Self-expression: In **P3** users wanted to express themselves and the daily activities through shared photos.
- Self-presentation and building identity: In **P5** and **P6** users were motivated to present themselves in a certain way through the music they shared.
- Promoting my views: In **P5** and **P6** users found it motivating to promote their ideas and views through the shared content.
- Monitoring self by statistics and history: In the study **P1,** users were stating in the start of the trial that they are motivated to keep a training diary for themselves with their recorded exercise data. Self-development and pushing one's limits in the exercises was motivating to follow.
- Showing one's skills: showing and expressing one's skills was evident in **P1**, where participants wanted to show their expertise in different sports to other members of the community.

Factor 3: Connectedness

Connectedness is a social factor, which relates to the basic psychological needs of belonging (Maslow, 1943) and need of relatedness (Ryan & Deci, 2001). Belk's work (2008) clearly divides sharing into two different categories: *sharing in* includes strengthening bonds within a group you know and *sharing out* includes making new contacts and reaching new audiences. Goh (2009) lists motivations of sharing to people you know under the themes *sharing key moments, Common ground, storytelling and sharing daily activities.* In the Hassenzahl model on needs (2010), connectedness links to *relatedness-belongingness.*

In the case studies, the *connectedness* factor was evidently present in all. Users stated that keeping in touch and being aware of others were essential motives for service use. A study by Salovaara and others (2006) of collaborative mobile media creation also suggested that awareness cues motivate participation. Work by Malik and others emphasized seeking attention and affection through content sharing (Malik 2016). In the case studies, for example in **P1**, users decided to share their exercise data to other users to collect feedback, comments and general peer support from other users. In **P2** *Connectedness* was evidently important, as the participants were interested in forming a group with familiar people, but participants also positively received the idea of forming bigger and more anonymous collectives with random strangers

From the case studies, the motivating factor *connectedness* was found in different content-mediated interaction activities. In the study **P2**, the content-mediated interaction activities *creation, sharing* and *enrichment* were present in the activities that the participants performed. In **P3** as a *consumption* activity, the friends' content appearing in the application was stated to be interesting to follow in real time. For the CMI activity c*reation,* in **P5** creating playlists for the collaborative and social use was motivating. A *Sharing* activity occurred in **P3** where users were motivated to share meaningful experiences through photos. Awareness of others in the group through the content they shared was motivating in the activity *following* in **P4** such as the discussions and added comments around the shared photos was stated to be a motivating activity of *enrichment* in **P4**.

In the synthesis of the case studies, following motivation themes were identified and constructed as the motivating factor *connectedness:*

- Communication and connection: In **P3** participants emphasized the importance of the possibility to share the photos through the Social Camera application and sharing them instantly with the group. A shared folder was adopted by the users as a communication channel for the group.
- Relationship and relatedness: In **P3** different forms of photo-based communication and experience sharing occurred, partly because textual means to communicate intentionally were scoped out of the implementation of the application.
- Storytelling: In **P3** users shared meaningful experiences through photos
- Reminiscing and remembering: Creating a memoria of past events, where users were together, was stated as important in **P2** and **P3**.
- Reciprocity: In **P6** users were motivated to give recommendations of music to others in order to receive recommendations similarly from others.
- Sense of community: Social awareness of other users in the same group, application or community was stated to be motivating in **P1, P2, P3, P4, P5** and **P6**.
- Social outreach: In **P5** users stated that making new connections and meeting new people were important in sharing economy services in addition to *instrumental* motivations.
- Peer support and encouragement: In **P1** users were motivated to get peer-support from other users in the same community.

Factor 4: Collaboration

The *Collaboration* category relates to working together and contributing to the community. Additionally, comparing self to others and competition are part of the collaboration category.

Collaboration is a motivation category that connects both *pragmatic and hedonic* needs. For the pragmatic part, it includes motivations such as completing things together, contributing to the community and cooperating, and then from the hedonic side, things such as comparison, contesting and being part of a group. Collaboration links to both extrinsic and intrinsic motivations and to the categories of relatedness and competence in Ryan and Deci (2000). In the Hassenzahl's needs model (2010), it links to *influence-popularity* and *security-control.*

The collaboration factor is evidently one of pragmatic nature. Antin et al. (2012) studied Wikipedians and their motivations to participate in writing for Wikipedia, and they found that users saw that contributing to a collective effort was interesting because of the collective outcomes that they were able to see. Salovaara and others (2006) in their work on mobile collaboration in events listed that creating a common space to collaborate in and enabling emergence of *collective objects* facilitated cooperation and motivated users. Goh (2009) listed informing and decision making as pragmatic motivations to share content. McMillan and Chavis presented the concept of sense of community (1986), which consists of the feeling of membership, the feeling of influence, integration and the fulfillment of needs, being a shared emotional connection. Blanchard and others extended the knowledge on online communities (2004). Social recognition is a theme that is partly overlapping in the factors *connectedness* and *collaboration*. Partly, the more pragmatic needs and motivations of gaining feedback and information are part of *collaboration*, whereas hedonic and emotional needs, such as relatedness and belonging, are part of *connectedness*.

From the case studies, the motivating factor *collaboration* was found in different content-mediated interaction activities. For *consumption,* the Collaborative filtering of the data and finding meaningful exercise content was stated to be motivating in **P1**. Producing video remixes together as a *creation* activity in **P2** was motivating. In **P3** it was observed that coordinating meetings and group activities with shared photos was a motivating part of the *sharing* activity in **P3.** In **P5** following how others consume and give feedback on their content was motivating and helped participants to contribute in a more targeted manner, as a *following* activity. For *enrichment* activity in **P6,** positive inconsistency of collaborative playlists was stated to be motivating.

In the synthesis of the case studies, following motivation themes were identified and constructed as the motivating factor *collaboration*:

- Contributing, providing knowledge and altruism: In **P1** and **P5** users were motivated to be able to share their knowledge, especially in relation to exercises.
- Teamwork, cooperation: In **P2** users saw the value of a collective effort of contributing the video clips to the automatically created remix, being a part of the video-creating collective and seeing the collaboratively created remix as the end result.

- Creating together: In **P2** collaboratively created remixes were stated to raise the quality of the user-captured videos. In the interviews of the study, users highly appreciated the idea of having a possibility to spontaneously form a video creation collective at the events that they were taking part in.
- Inspiring others: In **P4** collaboratively experiencing the photos and commenting on them was stated to be a pleasant experience, which was also stated to add motivation for the participants to share the photo content in a more targeted manner with the small groups.
- Competition and comparing: In **P1** and **P5,** users were motivated by comparing themselves to other users around the same activities.
- Provoking: In **P5** users expressed motivation to share content to provoke others. Partly provoking jealousy and provoking discussions were stated to be motivating in content sharing.

Belonging and sense of community: In **P1** users stated that feelings of being a part of the community around the same sport was motivating.

Factor 5: Enjoyment

Enjoyment has motivations such as fun, aesthetics, consuming content and gaining inspiration. Enjoyment is a highly social *factor*, tightly linked to *connectedness* and *collaboration.* Especially when *enjoyment* relates to sharing experiences and doing things together, enjoying as a group. Enjoyment is a crucial part on deciding if the user experience of a service is successful or not. Enjoyment and playfulness are themes that are essential in the design of entertainment services. Brown and Juhlin (2015) sum that enjoyment is ordinary, worldly, felt and skilled. Enjoyment is highly hedonic and an intrinsic motivation factor. Enjoyment partly consists of easy and boundaryless use of the system as well as easily accessible and browsable content. In the case studies, *enjoyment* was evident in **P1**, but it was drawn as a full motivating factor after case studies **P5** and **P6**. In the Hassenzahl model (2010), it links to pleasure-stimulation.

From the case studies, the motivating factor *enjoyment* was found in different content-mediated interaction activities. In **P3** watching others' photos appearing in real time to the shared folder was a motivating activity of *consumption*. In **P1** recording exercises were stated to add enjoyment to the sports, which is part of the activity *creation*. Telling stories to others via shared photos was stated to be a motivating activity of *sharing* in **P3**. For the *enrichment* activity, in **P4** users stated that commenting on the content that the others shared was enjoyable. In **P6** users stated that following the popularity of their playlist content was enjoyable, which is a part of the *following* activity.

In the synthesis of the case studies, following motivation themes were identified and constructed as the motivating factor *enjoyment*:

- Enjoying the content: In **P3** users stated that enjoying the content from others in the same small group was enjoyable.
- Sharing joy and experiences: In **P5** users stated that sharing positive experiences to others was important, for example, in sports and music applications.
- Amusement, aesthetics, and pleasure: In **P6** users stated that visually augmenting the playlists with the related mood picture was pleasant. In **P5** it was stated that aesthetics of the service and the shared content was one of the reasons to use the services.
- Activity and productivity: In **P5** users stated that being able to share their content and express their activity and productivity publicly in the service was a motivation to create the content.
- Flow of use: In **P2** the easiness of creating collaborative remixes was stated to be motivating.

Factor 6: Instrumental

The *Instrumental* category includes extrinsic motivations – getting external incentives for doing something. It consists of aspects such as gaining income or popularity. Instrumental motivations are often pragmatic and extrinsic. Instrumental includes motivations of doing things for external motivation, for example, popularity, money, even if in some cases it goes against one's intrinsic motivations or values. Instrumental motivations can occur in the form of doing activities to collect virtual or real income or other forms of incentives.

Social exchange theory (SET) concentrates on the instrumental motivations of sharing (Homans, 1959) when users evaluate the possible costs and benefits of sharing content. Bellotti et al (2014) list motivations of using sharing economy services, and they found out that even though most of the motivations are of *instrumental* nature, there are more intrinsic and hedonic motivations present. In the Hassenzahl's needs model (2010), instrumental connects to *physical-bodily* and clearly to *money-luxury.* In the case studies, the instrumental motivating factor was identified in **P5**, having a clear relation to sharing economy services.

From the case studies, the motivating factor *instrumental* was found in different content-mediated interaction activities. In **P5** users found it motivating to discover the cheapest or best option available easily through the service, which is part of the *consumption* activity. For the *creation* activity, in **P5** listing one's own resource digitally to promote it (for example, AirBnB) was motivating. Promoting one's own content within the service was stated to be a motivating activity of *sharing* in **P5.** Giving recommendations and feedback to other users was a motivating activity of *enrichment* in **P5**. For the *following* activity, in **P5** users stated

that building the reputation through the comments and reviews from other users was stated to make users more trustworthy, and collecting and following them was motivating.

In the synthesis of the case studies, following motivation themes were identified and constructed as the motivating factor *instrumental*.

- Gaining income or saving money: In **P5** users stated that one of the main motivations to list their resource to the services was gaining extra income.
- Building reputation: In **P5** the users stated that one of the motivations to use the sharing economy service was to build a reputation by getting reviews from other users.
- Professional growth: Users saw it motivating to be able to develop professionally by using the sharing economy services in **P5**.
- Benchmarking: In **P5** users saw value and motivation in using the service as a way to benchmark other users' offerings and shared content.
- Information seeking: in **P5** users found it motivating to discover the cheapest or best option available easily with the service (for example, AirBnB and Uber).
- Promotion of my content: In **P5** and **P6**, users stated that promotion of one's content to make it more popular is motivating.

To summarize the motivating factors in the case studies: In the study **P1**, we identified activities that users performed with their recorded exercise data. Interestingly, users were stating that in the start of the trial they were motivated to keep a training diary for themselves, which connects to the motivating factor *curating self*. After some use, the users got interested in the attention from other users. For example, comparison to the activities that others shared in the service, enrichment from others to their content, peer-support and instructions from others were social interactions that motivated them to upload the exercises and share them in the services. These findings connect to the motivating factors *connectedness* and *collaboration*.

The results of the study **P3** reveal six enablers of instant photo sharing: sense of connectedness and social awareness, presentation and expression of self, lightweight and surprising interaction, collective photography, documentation of experiences and privacy and user control. The motivating factors *discovery, curating self, connectedness, collaboration* and *enjoyment* were present in the findings from the study. In **P4** the motivating factors *connectedness* and *collaboration* were evidently present in the findings.

Findings of the study **P5** suggest that most of the motivating factors occur with different types of content. All the six motivating factors were present within the six emergent types of content. The study **P5** focused on *sharing* and *consuming* activities, but in the analysis, content *creation*, *enrichment* and *following* the content were also present. Findings of the

study **P5** compare the motivating factors and their occurrence with the six emergent types of content.

Results of **P6** describe the content that users created during the trials and a total of 16 social usage patterns were identified in the use of the system. The concept was found to be motivating, and it was stated to support discovering new music through social interaction. The social usage patterns describe activities that users performed in relation to the content with the service. The findings suggest that *collaboratively* creating the playlists and the social discovery of new music (*connectedness*) were appreciated by the participants.

5.4 Element 3: System

The third element in the CMI model is *system*. The *system* element consists of the technological platform and the user interface level features that the service offers. The system is the *technological context* in which the interactions with content takes place, for example a service or application. The *system features* describe functionality that facilitates CMI. As described in section 5.2., user's activities are either supported or prevented by the features, that user interacts with on the user interface level.As with all the other elements in the CMI model, the *system* and its properties were identified from the synthesis of the findings from the case studies. Figure 7 describes the system element.

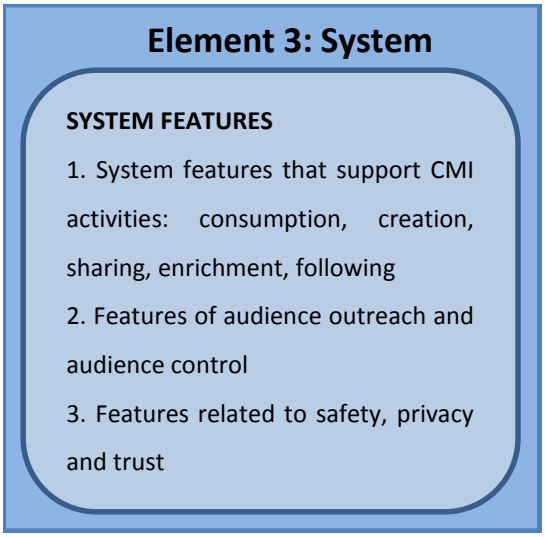

Figure 7: System element of CMI

Figure 7 describes the system attributes and the related features identified in the case studies. The features that support the CMI activities are described in the following sections activity by activity. *Consuming* the content is affected by the features of discovering the content as well as the relevancy and interestingness of the content. Features for consuming

the content link to the motivating factors *discovery* and *enjoyment*. All of which are affected by the *browsing, searching* and *content discovery* features.

For the features that support *content consumption,* the content access, discovery, browsing and searching features were appreciated. In **P5** users emphasized recommendation and discovery algorithms of the music services as one of the most important features that affect the decision on what service to use. Searching and browsing the content and the supporting features such as ordering pull content, targeted and smart content, using other users' preferences as a way for social navigation, automatically revealing the content related to them, having subscriptions to the interesting channels and users, and finally having content quality mechanisms were listed as the features that support the *consumption* activity.

The perceived *interestingness* of the content affects the user experience in the consumption activity (Malinen & Ojala, 2012). In the study of social media use on smart phones, four main content types that interested users were identified: 1) content related to me, 2) personally produced, 3) new and fresh content, 4) commented and liked by my friends (Malinen & Ojala, 2012). The system features connect strongly to the work on the social user experience by Väänänen-Vainio-Mattila and others (2010), where similar factors were identified. In the studies **P1, P2, P3** and **P5**, there were different factors emphasized by the users that affected the interestingness of the content. Temporal and spatial aspects affect the interestingness also, for example, how timely or fresh the content is (Malinen & Ojala, 2012), how well it holds its value over time and the locality of the content. Social factors such as popularity and the interest of others affects interestingness, as emphasized in **P5**. Seeing how many times the content has been viewed, how many visits to the content and how many times it has been commented on or shared can all indicate how interesting the content item is. The personality and targetedness of the content importantly affects its interestingess. The personal relevance of the content is described by Jones (2008) as follows: 1. Owned by me, 2. About me, 3. Directed towards me, 4. Sent or posted by me, 5. Experienced by me, 6. Relevant to me. If the user feels that the content is personally targeted to him or feels ownership over the content, it is more interesting, as emphasized in **P2** and **P3**. Lastly, the perceived quality of the content affects interestingess. If the user feels that there is much of an effort from the other users involved in the content, it is more interesting. Also, the perceived technical quality affects the interestingness.

Features that support *content creation* were identified as functionalities that make the content capturing, editing and management easier. The *content creation* features link to the motivating factor *curating self*. Additionally, the motivating factors of *instrumental* and *collaboration* were identified to be relevant for the content creation. Content capturing capabilities and features supporting the content storage were stated to lower the threshold of *content creation* in **P1**. For example, the features for automatically recording and capturing

content as well as monitoring it, as in the physiological data that was emphasized in **P1** and **P5**.

Features that support *sharing* make the threshold for uploading the content easier. In the studies **P1, P2** and **P3,** instant and spontaneous sharing was emphasized by the users as one of the enablers for sharing. The content sharing features link to motivating factors *connectedness* and *collaboration*. Instrumental motivations were also involved when users were connecting and communicating with other users in **P5**. On a higher level, the features that enable social awareness in the system can support sharing. Being able to see others' content and activities lowers the threshold for sharing their own content, as suggested in **P1**. Features that support the *audience control and outreach possibilities* directly support sharing. In **P3** users emphasized the value of limited sharing to the small group as an enabler of a low threshold of sharing content. However, in some sharing cases, it is important to be able to reach large audiences and to broadcast the content as widely as possible, as emphasized in **P5**. Comments, discussions, private messages and features for communicating support the sharing activities.

For the features supporting *enriching the content,* users emphasized the importance of features that support collaboration. The most important related motivating factors for enrichment are *collaboration* and *connectedness*. People are motivated by doing activities with content together and connecting with others through the content enrichment. Features that enable *enrichment* in **P2** and **P3** were identified as features that support shared ownership of the content. In the **P4** study, different user roles were emphasized. For example, some users are the initiators of the content and some enrich the content initiated by others by commenting and leaving marks about their visit. For content enrichment, features that support content creation through consumption (Vyas et al. 2012) were emphasized in **P4**. For example, light features of giving feedback and ratings and visualizing the amount of others' activity and visits to the content were features supporting consumption. In **P2** the features that supported the coordination of a group effort and collaboration were emphasized as main features to support content enrichment. Features for re-using others' content, such as re-mixing and re-sharing, were emphasized by the participants in **P5** and **P6**.

For the features supporting *following the content,* users emphasized the importance of features that allowed them to see others' actions. Features of following the content link to the motivating factors *curating self*, *connectedmess*, *collaboration*, *enjoyment* and *instrumental.* It was stated by participants in **P1, P3, P4, P5** and **P6** that revealing the popularity and actions of other users related to the shared content was important. Additionally, reaching the top lists of popular content was an important motivator for some users. Following the content is important for finding new contacts and content.

Audience control and outreach possibilities include a plethora of features that have an impact on all the content-mediated interaction activities. Because audience control is partly limiting the publicity and partly reaching out for new audiences (Litt & Hargittai, 2015), the emphasized features include both limiting the access to content and the visibility of the content as well as broadcasting and making it more widely visible. For the audience limiting in **P3** and **P4,** users emphasized sharing instantly to a very limited group. Limited groups and interest circles and also targeted sharing and open sharing to a limited audience were all important. Unfriending and blocking options were listed as methods of limiting the access whereas in **P5** and **P6,** users emphasized reaching broad audiences for their shared content Bringing contacts from other services, cross-service publishing and sharing was stated as methods to reach large audiences.

Features related to safety, privacy and trust were emphasized especially in relation to the services that related to the *instrumental* motivating factor. In the sharing economy services, it was emphasized that *reputation* builds the trust between users. The possibility of giving ratings and reviews was emphasized as a way to ensure that all the parties were trustful.

5.5 Element 4: Other Users as Social Context

The fourth element in the CMI model is the *other users as the social context*. They form the social context in the services. Case studies were completed in different social contexts. In one CMI activity, users generate and create content that develops in the later activities of the interaction. After sharing the content, social context takes a role in the CMI. The element "other users" is described in Figure 8.

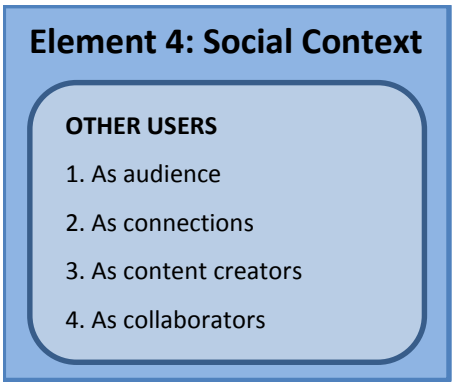

Figure 8: Other users as social context, element of CMI

Users have a *perception or expectation* of the audience they share their content with. After sharing, the actual audience that the content reaches will be unfolded – if the service has features for following the reached audience. The audience can take an active role in the CMI

as content *enrichers or collaborators*. Social context is the user base of the system, if the system is limited. Social and technological context mutually affect the content attributes.

Other users as *audience* (Figure 8) describes how other users create the social context in the service to whom you share with. They are the audience to which you share. Audience affects the user experience, and it is essential to let users control the sharing and its audience. Previous research suggests that users use a selection of different services to manage their publishing, sharing and self-presentation online (Lampinen, 2014). Previous work describes strategies that users perform while doing audience management (Litt & Hargittai, 2016a; 2016b).

Other users as *connections* manifest the social activities in the CMI model. Other users in the system are contacts, connections and friends to whom you communicate with. Other users as *content creators* scope the content consumption side of the social context. You are able to discover and consume the content that other users have created and shared in the service. While *other users as collaborators* defines how others are able to interact with one's content and enrich it.

Controlling and reaching the audience is an essential activity in CMI. The user makes a choice to share content and makes an effort to reach the right audience. Ideally, the user reaches the right audience, but in reality, the actual target audience and the audience user expectations are different. The user may have an "imagined audience" (Litt & Hargittai, 2016a; 2016b) that she tries to reach; however, sharing also reaches an "invisible audience" (Bernstein et al., 2013). Making users aware of the audience and other users' activities often supports CMI. Understanding roles of other users in the CMI helps to design for activities, as they take place in a social context.

5.6 Summary of the CMI Model

The model of CMI consists of the previously presented four main elements: activities, user motivations, system and other users as the social context. Figure 9 shows the overall view of the model with all the elements and the related sub-categories included (Figure 9).

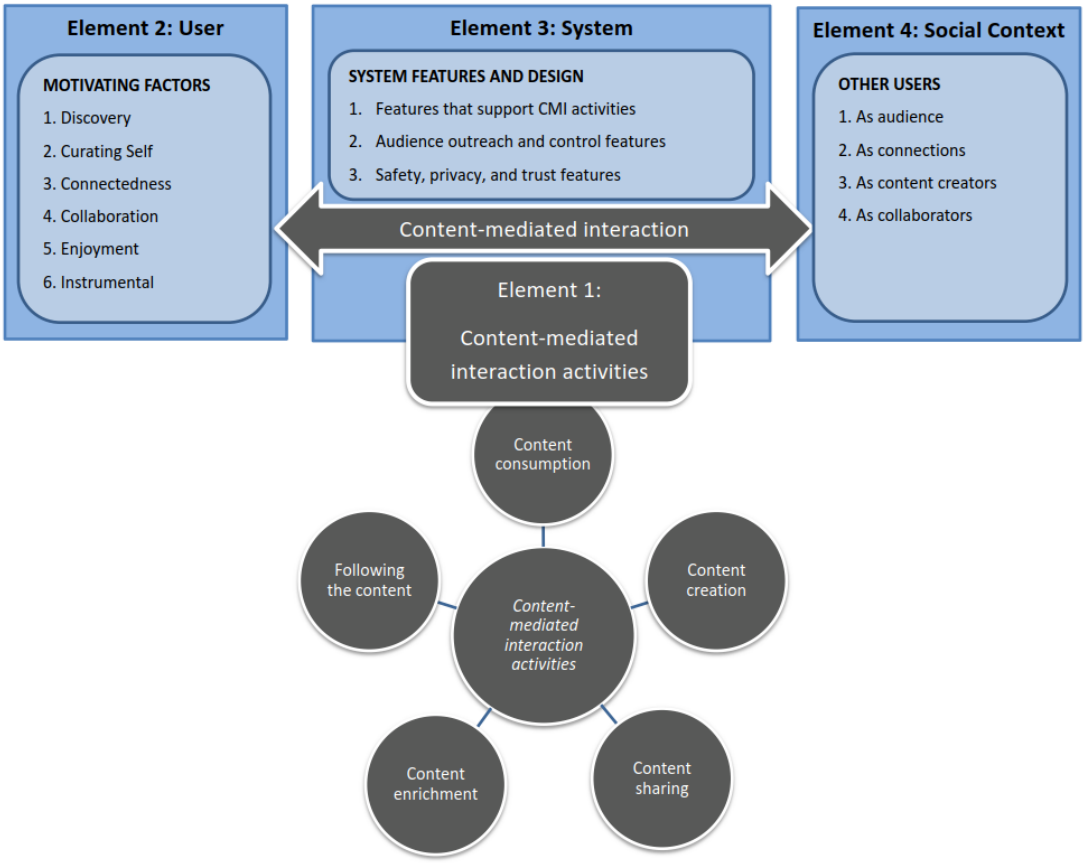

Figure 9. Elements that affect the content-mediated interaction

Figure 9 presents the CMI model in its entirety with all the previously described elements attached. Resulting model shows the 18 sub-categories that were drawn from the synthesis. For example, in *System* element, *features that support CMI activities* consist of the findings that relate to identified system features that support CMI acitivities. Publications give more detailed description and present the related empirical data in a form of the user quotes.

The model summarizes the concept of content-mediated interaction. The following chapter gives concrete design implications that relate to the model, depicting the possibilities and opportunities for design of new services that enable CMI.

6. Implications for Design

HCI and UX research traditionally has a strong drive towards practical outcomes – first of all producing easier to use and more pleasant services and solutions. This section describes which elements affect the user experience related to content-mediated interaction and which technical and design solutions can support them. The following section presents the design implications drawn from the findings of the case studies and maps them to the theoretical models presented in the previous parts of the thesis. CMI is first a theoretical model, which aims to understand the user experience and how it relates to the content-mediated interaction.

Findings from case studies were practically oriented and give actual implications for design. The following design implications describe how the findings can be manifested to the user interface design level.

6.1 Design Implications and Service Features Supporting Content-Mediated Interaction

Design implications address the **RQ3:** *What kind of design solutions support participation in content-mediated interaction?* Design implications focus on the *system* part in the model, and they are elaborated on from the empirical findings of the studies. Users' comments and observations of their activities were thematically categorised, and this data was elaborated and interpreted into design implications. The following section gives explanations and concrete case studies as examples of the design implications. The design implications are presented under the motivating factors in the following section.

DISCOVERY

1. Enable creating and sharing content to be a way to discover new content in return

Supporting easy content consumption and discovery is essential for the pleasurable content-mediated interaction experiences. Allowing the use of others' content for discovering new and interesting content is essential. Recommendation algorithms were stated to be a reason to select between different content sharing services in **P5**. Users compared recommendation algorithms and their experiences of discovering new content, and it was evident that, especially in the music related services, it was one of the most important features of the service. Shared content can be a cue of the user's interests to the other users. Content can express things about the user that helps other users to share more interesting content. For example, in **P6** users were experimenting with the system by adding an interesting picture that provoked people to see what type of music recommendations got associated with that

image. Users wanted to create the playlist as an initiative for other users to add certain types of music. In **P3** participants were sharing photos that described their hobbies or interests and provoked the sharing of new content. Other motivating factors that implication links to are *connectedness* and *enjoyment*. The implication was present in the activities *creating* and *sharing*, and it was drawn from the findings in studies **P2, P3, P5** and **P6**.

2. *Enable easy content consumption as a way to learn and discover new*

Users are curious about finding new things and learning from the content of others. Also discovering one's skills, capabilities and how others perceive your content was important for the users. Revealing visits on shared content guides users to target their sharing. In **P1** peer support and feedback to your exercises was a main motivator to share content. Other users' content is an important channel to learn and discover new things.

Finding users with similar content tastes was one of the main motivators in the use of social media services in the studies. It is a strong motivator to be socially active in the service. However, statistics of how many times one's content is consumed and by whom it was seen by were very interesting and motivating. The most value was seen in interacting with friends and with those that have similar musical tastes, for example, have liked the same playlists and listened to similar kinds of music. Finding people like themselves through their shared content and finding ones that share your tastes are important. For example, in **P6** the main music discovery was happening while listening to playlists created by other users of the system. Finding people that share your tastes and like similar songs was important for music discovery. In **P1** users were extremely interested in others that had similar exercise habits. The implication links additionally to the motivating factors *connectedness enjoyment*, and *instrumental*, and the activities of *consumption, creation, following the content,* and *sharing*. It was identified in case studies **P1, P2, P5** and **P6.**

3. *Allow collaboration to create positive controversy and diversity – it makes content more interesting*

Collaboration can create more diverse end results than the users could perform on their own. For example, in **P6** *positive* diversity in playlists occurred when users made new associations with pictures and music and sometimes added unexpected songs to the playlist. This made the shared playlist more diverse and interesting for more users. Playlists evolved into something that the creator did not think of in the first place. In **P5** users appreciated creating virtual objects together, giving them freedom to be creative in their collaboration. This strongly connected to the *collaboration* and *connectedness* factors. Implications can be applied to all the CMI activities, and it was drawn from **P6**.

CURATING SELF

4. Give tools for creativity and self-expression – lower the threshold of sharing

Supporting the creativity of the user is essential to motivate content creation. Lowering the threshold of sharing one's content by the easy upload and instant sharing functions is important, but even more important is to create trust that the users' content is secure even when shared. Users stated they liked to gain inspiration from the content that others have shared. Also, encouragement, empowerment and inspiration from both the service and the other users are essential in supporting creativity. For example, in **P3** users were extremely interested in sharing pictures of their hobbies and everyday activities since the target audience was limited to their friends and their photos and were instantly responded to. In **P6** participants were eagerly promoting their tastes in music and also their personal views through the shared content. The implication links to the activities creation and sharing, and it was identified in case studies **P3, P4** and **P6.**

5. Enable self-monitoring and collecting personal history – allow self-development through content

Following one's own activities and history in the system are important. Especially in the exercise related services, discovering the details and history of your activities was an important motivation to use the service. Pushing one's limits was highly motivating especially in relation to the exercise sharing in **P1**. In **P1** the participants stated that monitoring and collecting data of one's self and keeping a sports diary or journal electronically was one of the reasons to upload the data to the services such as Movescount. Keeping a consistent quality in your content is important for many users and seeing the history of your shared content and activities supports it. In **P5** users were carefully considering their content quality in certain services, for example, travel data sharing and following the history of shares was important. The implication links to activity *following,* and it was identified in **P1**.

6. Blur the boundaries of publisher and consumer

Content consumption can be a valuable way to produce new information. Revealing the amount of visits, filtering the content by its popularity, showing the other content that was interesting for the visitors of a certain content and other such social navigation cues can develop passive content consumption to be an important method of producing information. In the **P4** study, users were open to revealing their consumption activities when they knew that they offered important information to others especially when the consumption activities were presented in an abstracted manner, such as number of visits, and it was not compromising privacy. The implication links to activities *consumption* and *creation,* and it was identified in **P4**.

7. *Allow users to build and express their identity through the content as they wish – different personalities have different needs*

People are willing to reveal to others what content they consume and create, but only to some extent. All of the users are not comfortable with sharing their content, for example, playlists or songs they listen to with anyone. Their own shared content, in **P5,** was stated to be a manifestation of self, and services should enable identity building with the shared content. Identity building, self-presentation or *profile work* (Uski & Lampinen, 2014) are often a conscious choice that users make; they are not willing to reveal everything. In presentation of self, what they want others to see may be somewhat different from all the content they consume.

Sometimes presentation of self is a choice of safety: not every detail of your exercises is safe to publish in real time. Reaching and controlling the audience are key features of a pleasurable content sharing service. Evidently, in **P6** where the features of the playlists enabled users to be social and add songs to the playlists of others, users appreciated MoodPic especially as a way to share music with the people they know - their friends and close ones. Still, many stated that there was no point in limiting the music discovery possibilities to friends only – sharing to a bigger audience increases the possibilities of reciprocity in recommending. The implication links additionally to the motivating factor *instrumental* and to activities *creation*, *sharing* and *following*. The implication was identified in **P1, P3, P4, P5** and **P6**.

CONNECTEDNESS

8. *Enable instant sharing – create a communication channel*

Content can mediate communication and strengthen the connections with the people you know. Additionally, shared content can start new discussions. In **P3** Social Camera application was used as an instant channel to communicate with both the people who were nearby and those that were distant. Pleasurable content-mediated interaction can be supported by creating features that support lightweight communication and content sharing – especially with close ones. The implication relates to the activities *consumption* and *sharing*. It was identified in the case studies **P3** and **P4**.

9. *Build connections between users – support experience of relatedness*

Shared content becomes social, and it is stated to strengthen the connections between users. The feeling of being related is one basic human need, and people want to be part of groups, communities and trends. In **P1** gaining feedback and peer-support from other users strengthened the relatedness with the service community. It was one of the most emphasized reasons to share exercise data. In **P2** being a part of a collective video remix was an important motivator to create and share video content to the service. In the sharing economy services,

building connections and relationships between users help create trust between the parties. The implication links to activities *consumption, sharing* and *following*. It was identified in studies **P1, P2, P5** and **P6.**

10. Enriching others' content increases activity and creates an open atmosphere –make the threshold for cooperation low

New content can act as a conversation starter with people whereas comments and feedback to the content supports reciprocity. Olsson (2009) described the "snowball effect" where attention to pieces of content draws more attention, finally adding an amount of enrichment. Social presence and a feeling that the community is active are important. A dynamic feel can be created by showing the latest activities of other users as well as offering the latest content. Openness in giving recommendations and creating playlists evolves over time and requires some learning, and a critical mass of additions and recommendations are made. In **P6** users stated that a way of discovering music was increasing activity in the playlists that they saw interesting. An open atmosphere of sharing playlists and enriching others' playlists occurred throughout the trial period. By adding new recommendations and thus steering the playlist style to a wanted direction often activated other users to insert even more songs to the playlist, and therefore it provided new music recommendations. In **P3** users also stated that they wanted to provoke discussion and content creation with their shared content. Interesting content in **P3** evoked interactions and opened up conversations through the content. The implication links additionally to the motivating factor *collaboration* and the activities *sharing* and *enrichment.* It was identified in the studies **P2, P3** and **P6.**

11. Increase Social Awareness by making the presence and activities of others visible

When users create content, usually they want it to be seen and others to respond to it or at least leave evidence of their visit. Following the popularity on the content you have shared is a highly motivating factor that was present in most of the case studies (**P1**, **P3**, **P4**, **P5**, **P6**). Also, finding "related content" and connecting others that have consumed one's content was important. Collecting history and thus visualizing popularity of playlists was stated to add a feeling of reciprocity in **P6**. Connection with other users was a relatively high motivational factor for using online music services in **P5**. The implication additionally links to the motivating factor *collaboration* and to the activities *consumption* and *following*.

COLLABORATION

12. Competition and comparing oneself to others motivates content creation

Competition can be a strong motivation for content creation. When users are aware that they are able to compare themselves to others with, for example, game-like features and compete in the service, it motivates content sharing. Users are motivated to feel competent and show it to the community. In **P6** the MoodPic service included activity points in order to make it

easy for the users to identify the lead-users and on the other hand to collect status and visibility in the community. In **P5** most users stated that even outside the game services, contesting and comparison with other users are motivating. The implication links to the activities *creation, consumption, sharing* and *following.* It was identified in studies **P1, P5** and **P6**.

13. Community and social awareness creates positive pressure to content creation

Social awareness and feedback from other users can enhance the quality of shared content. It creates a feedback loop, through which the user is able to gain feedback about the shared content. The user is able to learn by sharing, giving a possibility to target the shared content better to the right audience and specifically share the right kind of content. Positive pressure in sharing can act as a quality filter of the shared content. In **P6**, there were social protocols that evolved around playlist creation in collaboration. Social pressure made the song additions more targeted, since users were aware that the wrong kind of additions could be removed. The implication relates to the activities *creation, consumption, sharing* and *enrichment.* It was identified in studies **P2** and **P6.**

14. Enable group storytelling and group cohesion through content

For many, sharing their experiences and stories with the interest group was highly motivating. In **P3** and **P4,** it was evident that users were motivated to create collaborative collections, for example, document their special events with the group and re-experience them together. Enabling shared ownership of content and making the presence and activities other users perform with the content visible increases group cohesion. The implication additionally links to the motivating factor *enjoyment* and to the activities *consumption, sharing, enrichment* and *following.* It was identified in studies **P3** and **P4**.

15. Let users feel ownership over their content – allow them to control the collaboration

Providing information to other users was a strong motivator identified in the studies **P1, P2, P3**, **P5** and **P6**. Educating, sharing knowledge, and teaching others, but also gaining information from others in return was extremely important to the users. In **P2** we investigated how users perceived spontaneous group formation at the events they attended and found out that they were surprisingly willing to share their captured content to the spontaneously created group to be used in the automatically created video remix. Enabling possibilities to complete things together is important and motivates contributions to the community. In **P6** users stated that they felt ownership of their playlists in the trial. Even though they allow others to enrich their playlist and contribute to it, most wanted to have credit for their own lists and express themselves through their own lists. The identity of the content author was emphasized in **P4** where users wanted to have a nickname or icon of a user that has taken the photo, even though it was shared with the whole group. In the cases, where the content is a collaborative effort, it is suggested that one of the users should be the main author or initiator of the content.

Enabling different user roles, such as content creator, content enricher, feedback giver, re-mixer, re-sharer, organizer of the cooperation, etc. allows flexible collaboration in the services. The implication links additionally to the motivating factor *curating self* and to the activities *consumption, sharing* and *enrichment.* It was identified in studies **P1, P2, P3, P5** and **P6.**

ENJOYMENT

16. Allow users to seek and find new experiences and contacts

Easy content discovery possibilities, the ability to find the right content at the right time and the ability to connect with people were stated to be enjoyable features in a wide span of services in **P5**. Easy content consumption should be supported in order to let users get the experience of amusement and enjoyment. Browsing, searching and discovering the content is an experience in and of itself, so it should be designed as enjoyable as possible. The implication additionally links to the motivating factors *discovery* and *connectedness* and to the activities *consumption* and *following*. It was identified in studies **P1, P5** and **P6.**

17. Offer the interesting content automatically and notify users – make it easy to enjoy the content

It is important that the technical quality of content is sufficient and the content is accessible. Both the shared and consumed content can be used to identify what the content user is interested in. Content can be targeted to the user in three approaches: through detecting the social relationships, for example, friends content or content shared with friends, utilizing the content that the user has consumed or liked and finally through the collective filtering – detecting the content that has been most popular to the user's interest group. The implication additionally links to the motivating factor *discovery* and to the activities *consumption* and *following*. It was identified in studies **P3, P5** and **P6.**

18. Enable easy sharing of stories and experiences

Users should be given tools to create and to invent new ways to interact with the content. As sharing experiences and stories with the content are highly motivating for the users, it should be made easy and supported with enabling features. The implication links additionally to the motivating factor *connectedness* and to the activities *creation, sharing* and *enrichment.* It was identified in **P2, P3, P4, P5** and **P6.**

19. Allow users to follow the popularity of their content

Following the popularity of one's own shared content was stated to be enjoyable. Participants stated that it is one of the key motivators for content creation and sharing. Gaining popularity inside the user community was stated to be a reason for creating content. Following how many users listen to the created playlist in **P6** was stated to be a feature that motivates more

focused content creation. The implication additionally links to the motivating factor *collaboration* and to the activity *following*. It was identified in studies **P1, P5** and **P6.**

INSTRUMENTAL

20. Enable building a reputation easily and trustworthily

Building reputation is essential in the sharing economy services. Past actions and transactions in the service are a reference, which creates the trust between parties. To be able to save money or to collect income, the user needs to be trusted in the community and by other users. The implication links to the activities *consumptio*n and *sharing*, and it was identified in studies **P1** and **P5.**

21. Enable promoting oneself or one's resources

Easiness to promote one's own material to the right audience safely is essential for the users to be able to gain income or save resources. Broadcasting to wide audiences and wide outreach possibilities as well as collecting popularity and an audience to the content are needed and motivate users. The implication links additionally to the motivating factor *curating self* and to the activities *creation, sharing* and *enrichment*. It was identified in studies **P5** and **P6.**

22. Enable professional growth

Feedback loop of the system is important for users to grow professionally. Gaining recommendations, reviews of the shared content and feedback enable users to create the right kind of content and to share it to the right audiences. In **P5** users stated that in the sharing economy services, the feedback from the other users formed a channel for them to develop. The implication links additionally to the motivating factor *curating self* and to the activities *creation, sharing* and *following*. It was identified in the case study **P5**.

23. Make it possible to gather information and to do benchmarking

For instrumental reasons, understanding the market and the other users' offerings was vital for one's own content to be successful. Making it possible to do benchmarking and compare one's content and offerings to others is important in guiding the actions. The implication links to the activities *consumption* and *following* content, and it was identified in **P5**.

6.2 Summary of Design Implications

Design implications give a contribution to design of CMI services. Appendix 1 presents the design implications and connects them to the related motivating factors and activities in CMI. Additionally, it lists the publications, where the design implications were evident. The summarization helps designers to find implications that relate to the specific activity or select

implications directed to a certain motivating factor. The Appendix 1 also shows in which case studies the implication was identified or drawn from.

7. Discussion and Conclusions

The results of this work give an overview of the case studies by presenting the content-mediated interaction model and design implications. This chapter discusses the results of the case studies and the resulting model and links them to the research questions. Novelty of the contribution is discussed in relation to the earlier work. The limitations and methodological choices are critically reflected in the latter part of the chapter, which concludes with future research possibilities.

7.1 Research Questions and Contributions

The CMI model is a synthesized theoretical model, which lists the elements that affect the content-mediated interaction, the related user experience and the relationships between these elements. The model addresses both RQ1 and RQ2 by building a theoretical model for understanding CMI. The elements are further elaborated on to include specific functionalities and practical design implications, which reflect these elements at the user interface level. The results address the research questions as follows:

***RQ1**: What are the external elements that affect and contribute to content-mediated interaction and the related user experience?*

The first research question addresses the elements that affect the user experience in content-mediated interaction. The resulting CMI models describe the factors that affect CMI. The CMI model explains the design approaches that should be used in the service design to successfully support CMI. Finally, it predicts how different elements affect the user experience related to CMI.

The novelty of the model lies in combining different content types and different sharing contexts and highlighting the factors that relate to all of these. Primarily, the model helps researchers as a basis for developing evaluation measures and as a tool for analysing services and their features. Moreover, it enables the development of hypotheses and research designs in order to study the relationship of the elements in the model and the actual service features. Second, it supports designers and developers by guiding design choices in order to select a suitable palette of features for the services that enable content sharing. It can be used as a social features checklist for service designers to create and re-design content sharing experiences.

***RQ2**: What are the activities and related motivations in content-mediated interaction?*

The second research question addresses the activities in content-mediated interaction. The detected activities and related motivations from the case studies are presented throughout the results section, and their applicability to design is discussed further in the practical implications.

The theoretical contribution of this work is to identify the motivations that drive CMI in the context of various novel types of content, such as collaboratively created videos and music preferences. The work describes how the user's motivations to participate in the CMI can be supported by design. Understanding the outlying motivations, activities and user experiences supports the creation of new interaction features and service concepts. Content-mediated interaction describes the five activities that define user activities with online content. It is based on an earlier work by Lehikoinen et al. (2007), and the activities are all identified in the case studies. The five activities presented in the model are: consumption, creation, sharing, enrichment, and following. The activities are high-level user objectives, which consist of performing interactions on the user interface-level (Rosson & Carroll, 2002). Activities and motivating factors guide activity-based design, while the design implications in chapter 7 offer guidance on a more low-level design.

The CMI model introduces a total of six motivating factors: *curating self, discovery, connectedness, collaboration, enjoyment,* and *instrumental.* These identified motivating factors are overlapping by nature: usually the activities are motivated by more than one motivating factor. Publications 1- 4 identify the CMI activities and the motivational factors: *curating self, connectedness, and collaboration*. The sixth publication expanded on the motivational factors of *discovery*. The fifth publication expanded the factors by two new ones: *enjoyment and instrumental.* The first four of the motivating factors (*discovery, curating self, connectedness, and collaboration*) link directly to previous studies on the traditional types of digital content. Traditional online content sharing can be seen as *communicative* sharing of content (John, 2013). *Enjoyment* and *instrumental,* identified in study **P5**, connect to findings from studies on sharing economy services (Lampinen et al., 2016, Bellotti et al., 2015). Sharing economy services links to the *distributive* logic of sharing as well as virtual possessions in some cases (John, 2013). The findings show an overview of what and how six motivating factors are present throughout different types of content. The first five factors are mainly hedonic *be-goals* as described by Hassenzahl (2010) whereas the sixth category is clearly a pragmatic *do-goal*. The *collaboration* factor is partly pragmatic and partly hedonic.

Our findings suggest that users are motivated by both intrinsic and extrinsic motivators (Ryan & Deci, 2000) across all of the studied content types. Surprisingly, in the reported positive experiences, gaining money or advancement, which was the most obvious

instrumental outcome, was rarely reported. In comparison to the *uses and gratifications* theory (Dholakia et al., 2004, Smock et al., 2011) and research, the motivating factors can be seen as the expected outcomes of the service use, which guide the user's choice to use or not to use the service. In the longer term, the use evokes positive and negative user experiences, which affect the continuance of the use. This work suggests that motivating factors are a basis that help us to categorise the expected outcomes of the use that people desire.

RQ3*: What kind of design solutions support participation in content-mediated interaction?*
The third research question addresses the practical and design solutions that support the user experience related to CMI. In practical terms, the identified CMI model, the CMI activities, and the design implications help designers of web services and application providers to design better content management and sharing tools and services. The thesis presents design solutions in a form of 23 design implications, which are linked to elements of the CMI model and related activities. These design implications support the service design.

7.2 Conclusion

The results of this work further the knowledge of user activities and motivations in content-mediated interaction. The CMI model has two main uses. First, it is a theoretical model for evaluating and analysing existing services and their features to support CMI. Second, it is a tool for the design of services and applications. Additionally, the work can facilitate the creation of new service concepts and the identification of business prospects.

The CMI model demonstrates the content-mediated interaction phenomenon and depicts the related elements. It explains how the elements affect the user experience and makes generalisations of how similar human factors and technological features can shape the overall user experience. The four elements affecting CMI that are identified in the model are: *activities, user motivations, system,* and *other users as social context*. The model divides content-mediated interaction activities as follows: *content consumption, content creation, content sharing, content enrichment, and following the content*. The main contribution of the model is on the activity design level. Activities are on the level of goals and objectives of the user and driven by motivations. In contrast to interaction design, which focuses on how the features are offered, visualized and implemented (Sundar, 2008), activity design concentrates on the functionalities that help users to reach their goals and needs (Rosson & Carroll, 2002). The model of *content-mediated interaction* supports academics in understanding the CMI as a phenomenon and building further theories or models. The model offers tools for a user experience evaluation in the services that support *content-mediated interaction*. The novelty of the CMI model lies in combining different content types and different sharing contexts and

presenting the factors that relate to all of these. The model furthers the knowledge of HCI by defining the general elements that affect CMI.

The results of the work support design of novel services related to CMI. They help in selecting a set of activities to drive the design in an activity-based design approach. Furthermore, they support selecting a subset of features in a given service that can support the intended user experience in CMI. The model and its elements help predict the possible outcomes of making such early activity design choices. Design implications manifest these design choices on a more practical level, offering means to generate features and interaction level design ideas to support CMI activities.

7.3 Limitations of the Research and Methodological Discussion

As with all research, this work also has its limitations. It can be argued that qualitative research has problems with the generalisability of the results. As the findings aim for in-depth and exploratory results, the research was qualitative. The *reliability* of the results means how well the results last over time and how repeatable they are. The *validity,* both external and internal, of the results means how well the selected methods and measured items support the presented findings. In qualitative research, the *credibility* of the results is stated to be the most important (Lincoln & Guba, 1985), whereas in quantitative results external or internal validity is emphasized. *Credibility* as a term refers to how consistently the empirical qualitative data and the resulting theories match.

In this research, three factors affect the reliability and validity of the results: 1) selection of the research and data analysis methods 2) selection of the studied content types and services, and 3) selection of the participants and participating groups.

For the research, a case study approach was selected. This style of approach has known limitations on the generalizability and representability of the results. According to Yin (2003) the case study generalizability is not valid if the case is not as representative as was thought.

On the other hand, the case study approach in contrast allows flexibility in the design of the research process, as after each case study the scope of the next study can be re-designed and the findings reflected in the initial model constructed. Reflections on earlier work of other authors as well as results from own previous studies are important. In this work, the case study approach allowed iteration of the model.

The clear limitation of this research is the coverage of the participant population. The sampling in the case studies was convenient sampling. Since there were several case studies with industrial partners with prototypes and unreleased services, the user sampling mainly presented the potential user base for the concept. The case studies had a strong practical

approach of proving the concept or evaluating and improving the features or design. Limitation in the data collection lies in the self-reporting made by the users.

An obvious weakness in the CMI model is that even though it is based on the empirical findings of the case studies, they have not been validated. The model has been based on the empirical data from the cases by "theory building" (Eisenhardt & Graebner, 2007) and by following the *grounded theory* methodology (Glaser & Strauss, 2004; Strauss & Corbin, 1994; 1998). The phenomena in content-mediated interaction have been studied from different viewpoints in the case studies, which involved an extensive selection of different content types and different audiences and technology contexts.

The research conducted for the thesis consists of the wide collection of content types. However, it can be argued if the made selection is a good representative of selected content types, as the content-mediated interaction is a general model. As the research excludes personal content management - managing the content that is not shared or made public, and the motivation to make the choice of not sharing must still be studied. In future studies, understanding the choice to keep content private can help us to better understand the boundaries of private and shared content.

7.4 Future Research

Content-mediated interaction aims to model different activities around the content. It also aims to see the different user roles that change in long-term use of the service. In different use sessions, users can perform different activities. For example, a novice user may be solely consuming content and take part in the content creation and sharing only in the latter use sessions. The work suggests that while performing different activities, users have a different interplay of motivations that guide their use. These different interplays require further research. The causalities of different elements and a systematic comparison of the different motivating factors in the model also need further research.

In the future work on CMI should be extended to include instant and ephemeral messaging services and the new types of sharing economy services. Also, new types of UGC should be studied in the context of CMI activities. For example, virtual and augmented reality content and 360 videos are emerging content types that will soon be within the reach of everyday users. Automatically detected and recorded data from multiple devices, for example, home appliances, and its sharing are phenomena that will need further study.

The broader effect of the social context to CMI was not in the focus of this work. The CMI model sees the social context merely as the audience and other users that are able to affect the content virtually through the given service. However, the broader definition of social context in the activity theory (Vygotsky, 1978; Leontiev, 1978) includes the larger construct of the

social context. The larger construct in the activity theory includes the shared histories and interpersonal relationships that affect how people perform activities. Expanding the work towards the direction where the social context is studied as a broader construct is a further research topic related to CMI.

In the future, findings on motivating factors, activities, and the user experience should be consolidated into a quantified model that describes reasons to share personal content and possessions in both physical and virtual realms. Extensive validation of the CMI model and its elements in the context of these new content types would be greatly beneficial for understanding activities with these content types. For further steps in the field of content-mediated interaction, research on the differences between specific types of content is suggested. Expanding the model further to the interaction design level is another one of the suggested future research areas.

For a reliable evaluation of CMI in the different services and applications, the model should be further elaborated on in an online survey that compares the different elements of CMI through scaled questions and as an output gives a rating of their implementation. Constructing this set of questions and the tool is one of the possible next steps in the CMI research.

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Appendix 1: Summary of the design implications

#	Design implication	Motivating factor(s)						CMI activities					
		1.Discovery	2.Curating Self	3. Connectedness	4. Collaboration	5. Enjoyment	6. Instrumental	Consumption	Creation	Sharing	Enrichment	Following	**Publications**
1	Enable creating and sharing content to be a way to discover new content in return	X		X		X		X	X	X			**P1, P2, P3, P5, P6**
2	Enable easy content consumption as a way to learn and discover newe	X		X		X	X	X		X			**P1, P3, P5, P6**
3	Allow collaboration to create positive controversy and diversity – it makes content more interesting	X			X	X		X	X	X	X	X	**P6**
4	Give tools for creative use and self-expression – lower the threshold of sharing		X						X	X			**P3, P4, P6**
5	Enable self-monitoring and collecting personal history – allow self-development through content		X									X	**P1**
6	Blur the boundaries of publisher and consumer		X					X	X				**P4**
7	Allow users to build and express their identity through the content as they wish – different personalities have different needs		X				X		X	X		X	**P1, P3, P4, P5. P6, P6**
8	Enable instant sharing – create a communication channel			X				X		X			**P3, P4**
9	Build connections between users – support experience of relatedness			X				X		X		X	**P1, P2, P5, P6**
10	Enriching others' content increases activity and creates an open atmosphere –make the threshold for cooperation low			X	X					X	X		**P2, P3, P6**
11	Increase Social Awareness by making the presence and activities of others visible			X	X			X				X	**P1, P3 P4, P5, P6**
12	Competition and comparing oneself to others motivates content creation				X			X	X	X		X	**P1, P5, P6**

13	Community presence and social awareness creates positive pressure to content creation				X			X	X	X		X	**P2, P6**
14	Enable group storytelling and cohesion through the content				X	X			X	X	X	X	**P3, P4**
15	Let users feel ownership over the content – let them control the collaboration		X	X	X			X	X	X	X		**P1, P2, P3 P5, P6**
16	Allow user to seek new contacts and experiences	X		X		X			X			X	**P1, P5, P6**
17	Offer the interesting content automatically and notify user – make it easy to enjoy the content	X				X		X				X	**P3, P5, P6**
18	Enable easy sharing of stories and experiences			X		X			X	X		X	**P2, P3, P4, P5. P6**
19	Allow users to follow popularity of their content - Following the popularity of one's content is enjoyable				X	X						X	**P1, P5, P6**
20	Enable building a reputation in the service easily and trustworthily						X		X	X			**P1, P5**
21	Enable promoting oneself or one's resources in the service		X				X		X	X		X	**P5, P6**
22	Enable professional growth	X					X		X	X		X	**P5**
23	Make it possible to gather information and to do benchmarking						X	X				X	**P5**

Appendix 1: Summary of the design implications

Original publications

Publication 1

Ojala, J. 2013. Personal content in online sports communities: motivations to capture and share personal exercise data, *International Journal of Social and Humanistic Computing,* 2 (1-2), 2013. .

Personal content in online sports communities: motivations to capture and share personal exercise data

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Abstract: Web services that support exercise have become increasingly popular in the last couple of years. This paper describes a qualitative case study that includes a trial use and interviews with 20 users of three different online sporting communities. These services enable users to add the training content from their personal tracking devices. In the interviews, data was gathered on the users' experiences and their opinions on the social needs and motivation to share content in online sports communities. The answers from the interviews were categorised into three main classes: social needs in sports communities, motivation for sharing content, and motivation for adding personal content to the services. As a result, users were motivated to create a personal exercise diary and content inventory online and also to share it with others in order to gain important information on exercising as well as peer support. Though the primary need for most users was a personal training diary, they also saw major advantages in sharing their data with the other members of the community.

Keywords: online communities; social features; social interaction; exercise; health; online communities; social media; personal content; personal inventories; design.

Reference to this paper should be made as follows: Ojala, J. (2013) 'Personal content in online sports communities: motivations to capture and share personal exercise data', *Int. J. Social and Humanistic Computing*, Vol. 2, Nos. 1/2, pp.68–85.

Biographical notes: Jarno Ojala is a Researcher from the Unit of Human-Centered Technology, Tampere University of Technology.

This paper is a revised and expanded version of a paper entitled 'Understanding user needs and motivations to share data in online sports communities' presented at 14th International Academic MindTrek Conference – Envisioning Future Media Environments, Tampere, Finland, 6–8 October 2010.

1 Introduction

Devices and technology to capture exercise data have made great strides in recent years. The development of heart rate monitors (HRMs) and GPS devices has created new possibilities for recording ever more detailed data on personal training. The developments

in automatic monitoring and online coaching can motivate users to exercise more and also help professionals in their training exercises.

The need to store, utilise, share, analyse, and understand this plethora of data also poses certain challenges. Until recently, this utilisation process was performed by transferring the data to one's own personal computer. Now, however, the development of online sports communities has given athletes the opportunity to share their training diaries online which has also added a social dimension to the process. The traditional use a handwritten training diary has now been superseded.

Users benefit from online sports communities in numerous ways. They can be motivated to exercise more and attain greater fitness, and communities can also generate essential information and knowledge of sports. There has also been a rapid increase in the number of online communities devoted to exercise, sport and sharing training information.

The main motivation for this study was to evaluate social implications, user experiences and the role of the community in three sports services. The study sets out to answer the following two main research questions:

1 What are the needs and desired functionalities for users in the online sports communities?

2 What are the personal, social and motivational factors for sharing the personal data? What motivates a user to create an exercise content inventory and to share it to the online community?

2 Related work

Earlier published research has reported on the motivational factors in using exercising software and related services. The literature also contains studies of online sports communities by identifying goal-setting (Consolvo et al., 2009a), how the multiplatform composition affects the experience (Wäljas et al., 2010; Segerståhl and Oinas-Kukkonen, 2011) and how these factors act as motivators for maintaining health and how they can motivate in creating personal goals for physical exercise. Technology-mediated physical exercise has also been widely studied (Ahtinen et al., 2008; Consolvo et al., 2006; Segerståhl and Oinas-Kukkonen, 2011).

In contrast, there has been relatively little research reported in the literature on the social aspects and the need to create personal inventories and share them in online sports communities. This paper presents design ideas for building an online sports community that enables users to create a personal training diary and motivates them to share it to others. Previous research has described how technology can motivate users to exercise more. Exercise services and devices can help athletes in their goal-setting (Consolvo et al., 2006, 2009b; De Souza and Preece, 2004) and guide them by monitoring their progress.

2.1 Social activity through exercise

In many cases, exercising involves social interaction. Athletes who exercise regularly typically have training buddies, team-mates or coaches, which introduces a social

dimension to exercising. This can promote enjoyment and sociability, and even improve performance when mediated through communication devices (Mueller et al., 2003; Wu et al., 2009). Social interaction can also motivate and support people to exercise more (Ahtinen et al., 2008, 2009).

The results of previous research suggest that social connections and the presence of other exercisers through a technical platform provide motivation for physical activity (Ahtinen et al., 2008, 2009; Wu et al., 2009). For more competitive athletes, it can even produce improved training results (Ahtinen et al., 2009; Wu et al., 2009). Wu et al. (2009) show that in the presence of exercising partners through a technical system, the social connection encouraged people to exercise harder and increased the overall enjoyment of exercise. Different social roles and relationships with other users can also be highly motivating: the service can allow a user to be, for example, a coach, exercise buddy, or sparring partner (Harjumaa et al., 2009; Wu et al., 2009).

2.2 Online sports communities

An online community is built on the basis of both weak and strong links between its members and, above all, shared interest (Girgensohn and Lee, 2002). On the net, active participation and strong emotional bonds between members allow the community to evolve and create content that is interesting and helpful (Haythornethwaite, 2005; Leitner et al., 2008; Preece, 1998). An online community can be seen as a platform that creates latent ties (Leitner et al., 2008), which are interpersonal connections that are technically possible but not yet activated socially. A previous study by Leitner et al. (2008) showed that people in an online community wanted to gather information and communicate about interesting topics, learn from other people, and maintain and strengthen relationships. In Leitner's research, motivation has been classed as either *extrinsic* or *intrinsic* (Bénabou and Tirole, 2003). Intrinsic motivation is the individual's personal desire to perform a task for its own sake, for the pleasure of completing it. Extrinsic motivation comes from external rewards or even sanctions that prompt an individual to perform tasks (Bénabou and Tirole, 2003; Mueller et al., 2003, 2007). The beneficial effects of exercising, such as improved fitness, can be motivational, but active participation within the community can also motivate the individual both intrinsically and extrinsically (Bénabou and Tirole, 2003).

Blanchard has described factors that create a 'sense of community' as follows: identification, support, relationship, emotional attachment, and obligation (Blanchard and Markus, 2004; Girgensohn and Lee, 2002; Haythornethwaite, 2005). The study finds that a good reputation, social status, and commitment and loyalty to the group motivate people to participate (Blanchard and Markus, 2004). A sports community can motivate its users to participate by giving social rewards that increase the user's credibility, status, or recognition within the community. These rewards can be in the form of goals or sub-goals or *achievements* (Malinen and Ojala, 2011) that are set for the user by the system or by the community. Users are able to attain these goals by completing certain tasks or doing a certain amount of exercise. Public commitment to specific long-range or short-range tasks can also be highly motivational (Consolvo et al., 2006, 2009a, 2009b; De Souza and Preece, 2004; Mueller et al., 2003; Maloney-Krichmar and Preece, 2002). The sense of the presence of others, even through online services, is shown to encourage exercise (Malinen and Ojala, 2011; Preece, 1998).

A community is based on the ongoing active involvement of its members. In online communities, peer support and empathy can be major factors in causing people use the service and contribute to it (Preece, 1998). Active and good-quality contributions create collective content (Olsson, 2009) and knowledge for the community, which is important to the users.

This study combines the area of social needs and how technological help and exercise data recording devices can motivate users to exercise more and share their training content via a community platform.

2.3 Personal inventories and the motivation to share personal content with others

As previous studies show, creating a personal inventory consisting of personal content can be one of the major reasons for capturing the data. However, creating personal inventories of the training data is an area that has received less attention in the literature. As the results of this study suggest, a personal inventory of the exercise history enables users not only to recall training events, but also to self-monitor their own exercise progress.

Previous studies have investigated the reasons for capturing personal content and creating personal digital inventories of it. Lehikoinen et al. (2007) have described the motivations for creating personal content: capturing and storing experiences, expressing self-identity and enjoying and sharing the digital content. Personal inventory that includes detailed data of one's exercises can also be sensitive in sharing sense, because it can give away private information that users may not be willing to share. Lehikoinen et al. (2007) have introduced the GEMS model that describes the phases of the personal content experience: get, enjoy, maintain and share. In the GEMS model, users get the information by capturing it with their HRM or other devices; they enjoy the content after the exercises on their PC; they maintain it by storing and organising it to the online services; and the exercise content can also be shared with others.

Training data recording can also be seen as creating a memento of one's training (Olsson, 2009; Olsson et al., 2008a, 2008b). The personal inventories that users create include digital representations of the actual event, to which they can add extra information (Olsson et al., 2007). This additional information may include subjective descriptions of the exercises or automatically created metadata (Vainio et al., 2009). This metadata may help in organising the content and also in retrieving it later on. Subjective descriptions also add emotional associations to the content and make it more empathetic, interesting and relevant to others (Olsson, 2009). Kärkkäinen et al. (2010) have studied the sharing of life-logs that include automatically recorded data of users' actions. In the study, users were willing to share the data but they also wanted to be in control of the sharing and recording of the data.

Social interaction and sharing with others introduces a new dimension to personal training content. According to Väänänen-Vainio-Mattila et al. (2010), self-expression, reciprocity, learning and curiosity were considered to be the main drivers for social user experience Olsson (2009) has created a framework in which the emotionally meaningful and collectively maintained content is seen as the central motivator for social interaction in close-knit communities.

3 Methodology

The field study included 20 Finnish participants who made use of three different sporting web services: Suunto Movescount, Sports Tracker, and Polar Personal Trainer. All three services contain various social elements and also community features that offer different ways to interact and share information with other users. During the research, Suunto Movescount was still in the development stage and not available to the public until its launch a few months after this study in May 2010. Sports tracker and polar personal trainer, on the other hand, had both been on the market for several years.

Trial use of the Movescount service, which lasted three weeks, took place in November 2009. It was completed by ten participants. The other participants were already users of the other two services at the start of the research.

The objective of this study was to identify both the personal and the social needs and motivational factors that are involved in sharing their personal training content. A comparative study between the services was not considered useful because the services were at different stages of development.

3.1 Services studied

The services studied were Suunto Movescount, sports tracker, and polar personal trainer. The main focus of these services is keeping track of one's own training, and adding training content to the service. Additionally, the services provide the means to share training content and include communal and social features, such as communication with other users. The services were selected because they all supported exercise recording devices and offered online community membership to the users.

3.1.1 Suunto Movescount[1]

Suunto is a large Finnish manufacturer of precision sports instruments and also designs online services for athletes. Suunto has implemented the Movescount sports community service for athletes. This was launched on the market in 2010, after the study. The main idea of the *Movescount* community is to offer a means to keep a training diary and to share it with other users of the service. Movescount offers support for automatically adding data from Suunto HRMs. As its main content, Movescount offers *Moves*, which is a compilation of the user's own training experiences. Users can upload the data recordings from Suunto devices and also input additional metadata and content about the weather, their feelings, as well as optional subjective descriptions of the exercise they take.

While *Moves* is the main content of the service, it offers a variety of social and communal features that enable its users to form groups and became fans or followers of certain users. During the research, the participants used the beta version of Movescount, which lacked certain social and community features of the final version. The idea of connecting with other users and following their training is to provide motivation for the user's own training. Users can share their Moves with others and also comment on them. Individuals can also form groups to share common interest in topics such as a particular sport.

3.1.2 Sports tracker[2]

Sports tracker tracks exercises and training routes by using GPS data. It also offers a platform to share exercise details and interact with other users of the service. The user's mobile phone and the sports tracker application record the data during the exercise sessions. Training data are recorded using a compatible mobile device or can, optionally, be added to the service manually. Users can also add informal content such as comments and pictures of workouts, which introduces the opportunity for self-expression (Mueller et al., 2003). Sports tracker also offers tools for finding new friends and training partners on the basis of one's location and for members to form groups.

3.1.3 Polar personal trainer[3]

The main purpose of the site is to store the user's training and strength training results and fitness data. Data can be uploaded using a compatible polar training computer or input manually. In addition, to basic information such as duration and calorie consumption, users can input additional notes about their training. The site provides statistics about users' training that help in monitoring their progress. Personal trainer also includes training programmes and strength training exercise instructions that users can integrate into their own training regimes.

3.2 Participants

A total of 20 users of three different sporting communities were interviewed in the study. The most popular sport was running, which 16 interviewees reported as being part of their exercise regime. Gym training and cycling were also popular sports amongst the interviewees; both sports were mentioned by nine people. Other sports mentioned by at least three interviewees were cross-country skiing, swimming, badminton, and combat sports.

Of the 20 interviewees, 13 were male and seven female. All the interviewees were very interested in exercising, but exercised with greatly varying frequency and for different purposes. The competitiveness of the interviewees varied from training professionally for the Olympic Games to jogging for pleasure.

The interviewees were also asked about their use of other online community sites. Most of the interviewees used Facebook or YouTube and half of them reported having visited discussion forums. Several interviewees also used Twitter.

In terms of their use of social web services, there was considerable variation among the participants. Most used Facebook (http://www.facebook.com) (12 participants), YouTube (http://www.youtube.com) (11 participants) or different discussion forums (ten participants). Twitter (http://www.twitter.com) (five participants) was also mentioned. Some used Facebook and similar social websites with great enthusiasm while others reported no interest in interaction through these services.

Ten people were recruited to test use the beta version of Suunto Movescount (five female, five male). Movescount users were all previous users of Suunto devices and were selected from Suunto's consumer database. Users of polar and sports tracker services were recruited through e-mail lists and were mostly students.

Table 1 Interviewee data

	Movescount	*Sports tracker*	*Polar personal trainer*	*Total*
Participants	10	7	3	20
Male participants	5 (50%)	6 (86%)	2 (67%)	13 (65%)
Age range	23–45	24–31	25–36	23–45
Students	3 (33%)	1 (14%)	2 (67%)	6 (30%)
Technically-oriented profession/industry	4 (40%)	7 (100%)	2 (67%)	13 (65%)

All of the Movescount participants lived in the Tampere region and their ages ranged from 23 to 45 years, the average being 35.7 years. Some of the participants knew each other or were relatives. Seven participants were users of sports tracker and three were users of polar personal trainer. The interviewees' ages ranged from 24 to 45 years, the average being 32.2 years.

Three of the participants were students while the remainder were in managerial positions or worked as specialists. Eight of the participants reported using a HRM almost every time they exercised, and two reported never using an HRM. Maintaining good physical condition was mentioned as the main motivation for exercising, but four of the participants also trained for sporting events and contests. These four participants also trained more seriously and thus wanted to monitor their performance more precisely.

These ten interviewees had used either sports tracker or polar personal trainer for at least six months. The most popular sports among these users were running (8/10), gym/weightlifting (5/10), and cycling (5/10). Six users stated that they usually exercise alone, two exercised with friends, and two said that they do both equally.

The participants were asked about how they recorded their exercise details. Half of them had used or continued to use a paper exercise diary, and seven used technical devices to record their exercise history (Excel, Suunto or other software, training-manager, Train Lite, etc.). Four of the users transferred the data automatically to a PC and half of them used internet services for documenting their exercise details. Eight of the interviewees reported using HRMs in most of their training. Nearly all (9/10) had searched the internet for information relating to training. Most reported sharing experiences about, for example, nutrition, feelings, accessories, and results.

3.3 Data gathering

The research data were gathered using diaries, interviews, and a survey. Interesting topics and the research questions were developed into interview questions, a trial diary, and surveys that participants would later fill in. The trial period of Movescount consisted of a three-week period in November 2009. The participants used the system and also kept a diary. The 'diary weeks' were followed by the user interviews. The trial use of the service was completed by ten participants. The data on the usage of the service during the trial were collected using structured diaries that contained positive and negative comments on the use session. All the interviews were recorded and the diary findings were discussed during the interviews.

Before the trial period, the users took part in an induction session where they were given passwords and usernames for the beta version of Movescount. The first survey was

also filled in during this session. In the first survey, users were asked which sporting and social media services they had used, and to provided background information on their sporting activities. During the three weeks of the free-form trial period, Movescount users filled in structured diaries to record their usage and user experience of the service.

The users of the sports tracker and polar personal trainer did not undergo a similar field trial because they had all been recruited for the study as experienced users of the services. However, they were also asked to keep a similar diary on their usage and experiences of the services. All the users filled in similar survey forms in the interviews.

4 Results

A large amount of data was gathered during the trial and the interviews. The data were divided into *findings*, one finding being a comment or opinion including a single thought concerning the social aspects of the services. The material provided a total of 447 findings that related to community or social aspects. The Movescount diaries amounted to 61 pages containing a total of 29 categorised findings. From the interviews 418 findings were listed. These categories include only findings that are related to the social or community aspects of the service. In order to conduct a content analysis, all of the interviews were transcribed and transferred to MS Excel. The transcriptions were divided into findings that contained one single comment or observation by the user. The findings were organised into categories that are discussed below.

The qualitative data analysis was made using methodology of grounded theory (Strauss and Corbin, 1994). All the comments and quotations were categorised into groups and a category name was later given to describe them. Since the services were at different stages of development, a comparative study between them was not considered useful. Still, all the findings are divided by the different services, because the social features and means to create personal inventories were different.

4.1 Overview of the results

After the content analysis of the material, several themes emerged concerning the motivational factors and desired features of the services. The categorisation of these findings can be used as a checklist for evaluating or implementing online sports services that attempt to add a social dimension to the data storing features.

Most of the users stated that their primary use of the service was to keep a personal sports diary. Sharing training information and social aspects was secondary, but most of the users considered that these were also very essential features.

Factors that create the motivation to use the services were also identified in the study material. The findings of motivations were two-fold: users wanted to add data for personal and private purposes in order to collect the data of their exercises and to monitor their development. They were also willing to share this data with others to add *social dimension* to the training. By sharing personal data, users wanted to contribute to the sport community and also to seek help and support from others. Many saw major advantages in sharing the training content with others and especially in seeing the content of others. The findings were grouped into two main classes: community and social needs; and motivation for adding and sharing personal training content.

Table 2 Categories of the findings

Categories	*Personal*	*Social*
Needs and desired functionalities	Personal statistics	Social interaction features
		Group features
	Personal training data inventory (content storage)	Communication features
		Privacy settings, control
Motivational factors related to using the services	Ease of adding and automatic transfer, automatically generated data	Content and information of other users
		Peer and community support
		Community and collective content
	Additional training data, aggregated/computed statistics	Online coaching
		Obtaining feedback and guidance from others
		Comparing and competing gaining reputation and status

4.2 Needs and desired functionalities

During the interviews participants showed a great interest in finding an easy way for monitoring their exercises. Capturing personal exercise data was highly motivated by the fact that users are able to create their personal exercise inventory to the services. Similar findings are made in a study by Consolvo et al. (2006). The participants wanted to track their earlier routines and compare them with their current performance. Personal inventory was seen as an essential way to self-monitor personal exercises and fitness.

Table 3 Identified needs and desired functionalities

Category	*Movescount (N = 10)*	*Sports tracker (N = 7)*	*Polar (N = 3)*	*Total (N = 20)*
Personal				
Personal statistics	42	21	1	64
Personal data inventory/content storage online	3	22	3	28
Total	*45*	*43*	*4*	*93*
Social				
Social interaction	53	6	5	64
Privacy settings	29	7	3	39
Group features	30	6	1	37
Communication	7	10	2	19
Total	*119*	*29*	*11*	*159*

4.2.1 Personal needs and desired functionalities

4.2.1.1 Personal statistics and monitoring

Keeping a sports diary electronically in the services was seen as being highly motivating. In addition, the users wanted to have various features for monitoring their training and keeping track of their development.

U6 "The exercises and adding feature were great. I would like it if the service guided me to exercise on the right intensity level and to recover."

U13 "I follow all my outdoor activities. I love keeping a diary that shows what I have done and where."

The users also wanted the service to monitor their development and provide advice if they are aiming at a particular goal.

U1 "This should show if the exercising makes sense or is over the top."

U20 "The main thing is the development monitoring. If I have decided to go faster, I can track where I got tired and could not keep up the pace."

Overall, automatically generated statistics and aggregations of the exercises were much appreciated.

4.2.1.2 Creating personal inventory/training content storage online

The users stated that they need a secure place to store their training content. Two of the participants said that they were more comfortable knowing that their content is stored in a database in the service because they could lose the data in their HRM or PC. The inventory was seen as offering online storage that could be accessed anywhere.

4.2.2 Social needs and desired functionalities

4.2.2.1 Social interaction

The users wanted various features for social interaction in the service. They wanted a means to communicate with other users through the service. Most of the participants wanted the opportunity to seek help or guidance or features to keep in touch with their friends via the service.

U10 "I want to contact my training buddies with it and to communicate with them!"

For maintaining active social interaction, the users appreciated the possibility of adding friends or contacts. The participants also wanted features that facilitate easy participation and comment. They mentioned many features that would add ways to interact with others in fast and entertaining ways, such as online chat, ratings ('like' or 'thumbs up'), polls, the direct sharing of content with certain users, linking, and live feeds of friends' activities. These fast and easy means of interaction would make it possible for busy users to show and maintain interest with minimal effort.

Keeping in touch with friends was seen as being highly motivating. The users wanted live tracking of their friends' exercise sessions to see when they are training. Sharing content with certain friends after exercising was also motivating.

4.2.2.2 Privacy settings

When asked about privacy issues, most of the participants wanted to have at least some privacy adjustment levels. Most wanted to be able to restrict their visibility to their friends. One of the users observed that she would like to have private exercise sessions, for example, prior to important competitions. The users felt that privacy settings that are easy to use but can still be freely modified can also promote trust in the service and increase motivation to share content.

Some of the participants also felt that information concerning personal health is confidential and should remain private by default. The category 'only my groups can see this' was the most popular option for sharing content. Most of the participants were more willing to share content with friends and acquaintances than strangers.

The personal training data inventory in the online service also raised some concerns over the privacy of personal data. Even though many users were active on social networking services, they felt that exercise content was private and vulnerable to abuse. In the groups they wanted to share and discuss exercise sessions that took place in an offline context, for example, places, dates, and results. They did not want outsiders to see this information.

4.2.2.3 Group features

The users reported that the intimate groups that they create in the service are more interesting than the whole service as a community. Such groups can evolve around users' location or training surroundings or a particular sport.

Some of the users wanted to say more about themselves and also to know more about other users. However, they also wanted privacy settings so that information can only be seen by their group members or friends. Users would make their feelings and experiences about the exercise sessions visible in their profile to selected groups and also give a more precise description of their activity and sporting history. Some interviewees also stated that their favourite routes should only be visible to selected groups.

4.2.2.4 Communication through the service

The users also needed more advanced features to inform their groups and friends about competitions or training events. Their communication needs were greater than merely adding a comment on another user's exercise or adding a 'thumbs up'; they wanted, for example, features allow the sharing of essential information on events and competitions with other users and groups. Users wanted to identify other users or contact them.

4.3 Motivational factors related to training, significance of the online sports community

From the interview material, factors were identified that relate to the usage and user experience of the online sport services. Users considered these aspects essential for supporting and guiding them in their training. Although the majority valued social aspects and the sharing of information, not all the trial participants felt this was important. Those who did not use Facebook or other social networking or social media services tended not to see this as particularly important.

U7 "It is just a training diary for myself, I'm not used to communicating through the net."

Table 4 Motivational factors for sharing data and number of findings

Category	*Movescount*	*Sports tracker*	*Polar*	*Total*
Personal				
Ease of adding the data/automatic transfer	23	6	0	29
Additional training information and related data	12	6	2	18
Gaining reputation and status	8	1	0	9
Total	43	13	2	58
Social				
Content and information of other users	55	21	5	89
Peer and community support/Social awareness	18	7	0	25
Online coaching/monitoring	19	1	0	20
Community and collective content	17	3	0	20
Obtaining feedback and guidance	8	3	1	12
Comparing and contesting	5	4	0	9
Total	120	39	6	165

4.3.1 Personal motivational factors

4.3.1.1 Ease of adding the data/ automatic data transfer

In the interviews, the users stated that they add almost every exercise to the service because it can be done automatically. Ease of adding information is more than a motivator; its absence can impair the experience: the automatic or easy data transfer from the recording device to the service was seen by some of the users as the most important factor in the sports service. Adding exercise information to the service and analysing it must be easy to do. The users wanted the service as a personal training diary and a place to store and share exercise data and experiences. U8: "There are many sporting services nowadays. I really want this to combine all the good features from all of the services in one single service!" Adding data manually was seen as time-consuming and tedious. Most of the participants wanted the services to support automatic data transfer from their HRMs or other recording device. U7: "I had automatic data transfer in the Suunto service I used before. Adding exercises manually is a huge step backwards". As noted earlier, many users were accustomed to the automatic transfer of their training data from their HRM and expected to be able to upload data on their heart rate, time, calorie consumption, etc., with the test service. The users observed that they would not like to add their exercise data manually. Even the automatic exercise uploads may be forgotten if exercising has no specific goal or frequency.

U8 "I would not bother to add the exercise data manually any more. I really need the data transfer to use this actively."

4.3.1.2 Additional training information and metadata

During the interviews, the users stated that additional information on the training sessions motivates them to see the exercise data and also to add their own exercise data. In the trial, the users were able to manually add additional information about the weather, their feelings, a description of the intensity of the exercise and route, etc. Users were motivated to modify the exercise content with their subjective descriptions.

4.3.1.3 Gaining reputation and status

The users considered that it is very important to see their own training history and also the history of others. According to them, training history affects the credibility of particular users in the system. The more seriously they have trained, the more likely it is that they are knowledgeable about what they are doing. Before exercising became competitive or the user had no specific goals, the recording and sharing of exercise details were not seen as important. Because reputation is established as a result of interaction among users, it can also be regarded as a social motivational factor.

4.3.2 Social motivational factors

4.3.2.1 Content and information of other users

Other users' content serves participants in two ways: meeting their information needs and providing entertainment and motivation. The users were mostly interested in the content of their friends and acquaintances. Some stated that initially they also wanted to see recommended content of strangers to get started since they had no contacts in the service. The content of others was seen as being inspirational and it was said to provide new ideas for one's own exercising.

The users wanted flexible features to put their information online. They wanted the option to publish details about themselves, though only the minimum of information should be mandatory in the profile. They wished to have basic information about other users so they could easily judge if the training content was comparable to their own. The users would also like to make their age, location, activity level, and training content publicly visible in their profile and they would also like to see such information on other users too.

Some of participants said that they would like to have a public profile with a limited amount of personal detail and also a more detailed profile that would be restricted to friends or group members.

The users liked the fact that they could see the training data of others and they wanted to get more information through the system about other people and the exercise regimes. The users also wanted flexible features for browsing, filtering, and searching for users and their content. The users also wished to have a forum in which to share thoughts and ideas and access information about training. They were especially interested in new routes and training programmes and ways to arrange exercising in groups.

The users were interested in the training data of others, though most of them noted that not everyone's content might have value. They stated that they want to see their friends' exercise details and comments, professionals' exercise information, and the content of people that is in some way relevant. This could include people in the same

locality or of the same age or at the same activity level. The users were also interested in the content of professional athletes.

4.3.2.2 Peer and community support/social awareness

According to the participants, following the activities and development of others is also serves to motivate oneself. Knowing that others have been exercising actively can act as a form of social pressure. Most of the interviewees stated that 'positive pressure' is highly motivating. When they see others' inspirational workouts or successful programmes, it encourages them to exercise more. Users wanted help and support from professionals and also peer support from others that do similar exercises.

U13 "Service motivates you to move. You can see the exercises of others and encourage others and create co-spirit." U12: "Even though your friends have not added exercises, service offers exercises of strangers. You feel that others are using the service. In many services the problem is that you feel like using it alone."

4.3.2.3 Online coaching

The more serious trainers among the participants also saw the need for online coaching. The system could motivate users by sending them training programmes and notifications automatically if the programme is not being followed properly or if the training has been especially hard. However, online coaching with their real coach through the service was also considered a very important feature. Through the system their personal coach could see their training data and give more specific training advice, regardless of location.

4.3.2.4 Getting feedback and guidance

The users were motivated to share their personal exercising content in order to gain feedback from other users, and also to get advice and guidance from more experienced athletes.

4.3.2.5 Comparing results with others and contesting

Some of the users expressed a keen interest in competing through the service. They mentioned that comparing their own performance and amount of exercise with that of others could be highly motivating.

4.3.2.6 Community and collective content

A major need in the sporting community is the creation and sharing of knowledge. When the community contains a vast number of sports enthusiasts from beginners to professionals, a great amount of information could be collected and shared in the service. The users also wanted the community to have access to a data repository containing a pool of collective knowledge and information. Information that the users wanted from the community included the following: common knowledge about sports and accessories, shoes, clothes, nutrition, information on sports injuries and recovery, the exercise diaries of both professional and amateur users, the guided training programmes of professionals

and their coaches, gym and weightlifting programmes and advice, guidance and help with training and resting as well as real accounts of progress through exercise.

Users also wanted information on their locality and the kinds of activities available if they want to take exercise in unfamiliar surroundings.

U8 "I just moved to Tampere, and I'd like to know about jogging routes here."

The participants also mentioned that they would be motivated to share more when they had access to other services, such as another exercise data recording system or Facebook, YouTube, or Flickr. The users wished to have automatic options to add their exercise details or an application that shows a summary of their training regime as part of their profile.

5 Conclusions and discussion

In this study, patterns of self-monitoring and social interaction related to exercising content were identified. In general, sociability and the support of others in the same community were seen as important in an online sports service. Many of the participants reported that recording and analysing the exercise data is the primary function and motivation for using these services. However, they also noted that social interaction online adds a new and welcome dimension to their training regimes. Most of the users showed a keen interest in including a social dimension in their training data recording.

Even though the three services studied varied considerably in terms of the social functionalities they provided, the interviewees were in close agreement on what they wished to have in their ideal community. The most important social needs identified in this study relate to communication and interaction as well as sharing knowledge with other users, whether friends or strangers. Through communication and sharing the users were seeking social support, new ideas to develop their training and the pleasure of sharing experiences and performance data.

As the results indicate, the implementation of social and community features, for instance, showed considerable variance. During the interviews, those who had not used community-related functionality made no mention of this as a motivator.

Most of the interviewees said that their primary use of the online sports service is to keep a personal training diary. Sharing training information and social interaction was secondary, though most users also acknowledged these to be essential features. They also felt that they needed flexible features for interaction through the system, for example, chatting or opportunities for more serious conversation. An online sports community can also offer essential information and guidance for training and add additional value by providing a platform for social interaction through the internet.

As previous studies show, most users were willing to share their exercise content with other members of the community in order to gain feedback and guidance from other users (Ahtinen et al., 2009). Having access to the exercise information other users also motivates people to create and record their own exercise information and make it public. That motivates users to become more competitive but also more supportive of each other.

The major differences between the users' responses concerned the questions about sharing behaviours. Some participants would make all their information and exercise details public, while others would prefer to keep most of their content private. Privacy was seen as a very important issue when exercise content is published. Modified and

adjustable privacy options can be a motivational factor when sharing exercising content. The users wanted flexible privacy settings in order to modify what they share and with whom.

This research was conducted to gain an insight into how an online community can motivate athletes in their training and to identify the most favoured social features. This study suggests important factors of social features that athletes want to have in a sports community. This study also finds that users are motivated in different ways when adding personal exercise content to the service and sharing their content with other users. Although the primary need of most users was a personal training diary, they also saw the clear advantages in sharing their content with other members of the community. The results of this paper can be used as a checklist when designing a sporting website that attempts to facilitate social interaction.

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Notes

1 http://www.movescount.com

2 http://sports-tracker.com

3 http://www.polarpersonaltrainer.com

Publication 2

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Automated Creation of Mobile Video Remixes: User Trial in Three Event Contexts

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ABSTRACT
This paper describes a user evaluation study of automated creation of mobile video remixes in three different event contexts. The evaluation contributes to the design process of the Automatic Video Remixing System, deepening knowledge to wider usage context. The study was completed with 30 users in three different contexts: a sports event, a music concert and a doctoral dissertation. It was discovered that users are motivated to provide their material to the service when knowing they get an automatically created remix containing many capturers' content in return. Automatic video remixing was stated to ease the task of editing videos and to improve the quality of amateur videos. The study reveals requirements for pleasurable remix creation in different event contexts and details the user experience factors related to the content capturing, sharing, and viewing of captured content and the remixes. The results provide insights into media creation in small event-based groups.

Author Keywords
Mobile videos; collaborative systems; user study; video remix

ACM Classification Keywords
H.5.1 multimedia information systems: video; H.5.3 group and organization interfaces: collaborative computing;

General Terms
Human factors; Design; Experimentation; Theory

1. INTRODUCTION
Most of us have been to a concert, a sports event, or similar, where numerous people in the crowd held a mobile phone to capture a memento of the event. It is rather common to see part of the crowd holding their mobile devices above their heads capturing the event. The habit of spontaneously capturing videos at any chosen event is becoming more common. What happens to these video clips after they are captured is an interesting area to develop new solutions. A major part of the social media use and personal content management nowadays happens with mobile devices such as smart phones, tablets, and other hand-held devices. The habit of amateur mobile video creation is a growing phenomenon [8, 9]. Online entertainment relies increasingly on user-generated content in social networking services (SNS) and social media. SNS such as YouTube, Facebook, Vine, and Vimeo rely on the video and photo content captured and shared by the users. Mobile video capturing, however, poses problems, as users are struggling with the growing amount of video content they have captured. In a study by Lehmuskallio et al. [14], editing these snapshot videos is a prominent problem that the users face. Eventually this content may be left on the devices, even though the original intention would have been to share it.

This paper presents findings from a user trial of a concept for collective creation of automated mobile video remixes. The concept is called "Automatic Video Remixing System" (AVRS). AVRS is a fully automatic, collaborative video remix creation system. AVRS uses the multiple videos captured by multiple users in an event to create an automatic video remix. The automatically generated remix utilizes multiple perspectives captured by the users' recordings at the event. The remix and the related collaborating group are created by the system in relation to an identified common event like a music concert, a sports event, or a party.

AVRS was originally introduced in [23], where the study compares the product and processes of automatic and manual remix creation. According to the study, although the amateur manual remix performed better in terms of subjective viewing quality, the users were shown to reduce their expectations if they knew beforehand that a remix was generated automatically. Subsequently, the AVRS was used to study the effectiveness of an automatically generated video remix as memorabilia [22]. In the second study, automatic remixes were seen to be fairly equal in acceptability as digital memorabilia of an event. The first two studies were about concert events, these studies did not address user experience aspects that may be of significance when using AVRS in a wider context. Studies did not investigate the design requirements of the front-end of AVRS system or the users' motivations or habits of capturing the videos in the first place.

Different types of events vary by the captured content, audience, and parameters for salient features. For example, a sport event may constrain the user to record from a fixed location whereas recording in a party event can be unconstrained. The audience in a concert may not know each other but have gathered for watching the same band perform. The salient features of a sport event (e.g., a goal or audience reaction) are different compared to a music concert (e.g. a popular song or a speech from the band) or a party (the host and the guests). Consequently, the authors found it

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essential to investigate the issues and requirements for collective automatic remix creation in different event contexts.

The goal of this study is to understand four areas which our previous studies of AVRS system did not address. Firstly, it aims to understand motivations and requirements for capturing and contributing video content for automatic video remix creation in different event contexts. Secondly, it identifies automatic video remixing requirements from different types of events. Thirdly, it studies how the collectively created remix is perceived by the users. Fourthly, it identifies features that are desirable to users in a collective video remix system and presents them as a guideline.

This work contributes to the understanding of requirements of an automatic remix and collective video creation in different contexts by event-based small groups. Additionally, the work contributes to the topic of social user experiences [24] by identifying factors that motivate users to share or contribute their video contents to an automatic video remixing service. Our approach of studying the automatic collaborative remix requirements in different event contexts is novel, which helps confirm some previous findings and bring up some results which indicate the need for further study.

2. RELATED WORK

A large number of studies have addressed the habits and patterns of photo sharing and experiences related to mobile photos (e.g., [11, 18, 21]). As mobile videos are increasingly becoming easier to capture and share, the photo-sharing knowledge needs to be extended by the special characteristics of the video content, as videos differ from photos in their temporal dimension. While a number of studies have addressed the areas of collaborative creation and content sharing (e.g., [18, 20, 21]) and collaborative video creation [2, 3, 4] the requirements of different events and the group formation remains a less studied area. Users face problems with their video content editing, especially in the situations where multiple streams of content are available. Automation in video editing can therefore drastically reduce users' time and make the process of video creation more enjoyable.

2.1 Automatic Video Remix Creation and Collaborative Video Creation

Many systems have been studied that utilize a semi-automatic approach to video editing in a collaborative setting for different scenarios, but its development and usage in a collaborative setting are still not completely understood. Engström et al. [3] investigated collaborative video production in a live video setting. The system uses a human-mediated approach for decisions about the choice of what is included from the content received from multiple users. In our study, we also explore the effect of automation in a collaborative video reproduction setting. Girgensohn et al. [5] used a semi-automatic approach for creating home videos, which required assistance from automation in analysis regarding the video motion's characteristics. In contrast with the above-mentioned approaches, the fully automatic approach presents new findings regarding the effectiveness and advantages of such an approach.

Systems using a fully automatic approach for music events have also been studied. Kennedy and Naaman [10] exploited the audio fingerprints from concert videos to organize the content. This approach depends on the number of overlaps to determine what is interesting enough to create an event representation. Shrestha et al. [26] presents an automatic mash-up creation approach that uses content from multiple users who were recording a music event. Our study investigates the human aspects related to user content contribution, collaboration, and effectiveness of automatic remixes in music and non-music events.

A prototype solution for collaborative video production, called Caleido is presented in the work by de Sa et al [2]. Caleido offers support for capturing the videos collaboratively, coordinating video capturing. Another approach by Bao et al. [1] utilizes mobile devices as sensors for recording and sensing the environment for creating event highlights. The work mainly focused on significant event detection and its effectiveness, it did not cover the larger user-related experiences regarding content contribution and collaboration. In a system proposed by Zsombori et al. [28], a narrative specification-based approach is used to create video compilations that utilize semi-automatically annotated content; the narrative is chosen by the viewer or derived from viewers' preferences. In the system proposed by Jansen et al. [7], the work by Zsombori et al. [28] is used as a dynamic video compilation.

None of these previous works have provided a detailed study of human aspects about the collaboration motivation and effectiveness of fully automatic system being used for different event types. Collaboration in video creation requires learning, which is addressed in the work by Weilenmann et al [25]. The learning can happen playfully by imitating the professionals, as the work by Juhlin et al [8] suggests. Whereas the presented systems utilize collaboration in the video creation, AVRS aims for collective video creation, since the collaboration is not needed on the video capturing moment. Instead, remixes are created from the collectively captured and shared videos. Interaction with the system in the moment of capturing is kept minimal.

Vihavainen et al. [23] studied use of AVRS at a large-scale festival. The study results suggest that remixes were assessed as important memorabilia equal to the manual remixes from the same event. In the study, users trusted the service and willingly handed over their video clips, even though they stated that they did not want to get acknowledged if their content ended up in the remix. Monroy-Hernandez et al. [16] divide acknowledgement in the content to "attribution" (automatic and computer generated) and "credit" (by other users). How interesting the content is to a user depends on its freshness, the person's relation to the content, the personal nature of the content, and whether the content is actually targeted to the receiver, as previous work suggests [15]. From this, it can be seen that preferences with regards to attribution and credits, as well as the audience [15], may vary depending on how personal the content is to the user.

2.2 Small Groups and Spontaneously Formed Groups

Previous studies suggest that people are willing to share personal content in private circles such as family or close friends [7, 17, 18]. Close-knit groups have needs for demonstrating their group identity and for collectively managing the content [17, 20]. This work extends the idea of small groups to the spontaneous groups that relate to a certain event and thus have a relatively short lifespan. Sharing with the people who were present in the capturing moment is referred to as "reminiscing" [20], and "storytelling" is telling those who were not present about the event [13]. In previous studies relating to small group sharing [18], it was found that small groups have problems in sharing the

picture content from many devices within the group and that people have suspicions over sharing the data on social media. One of the solutions that support small group sharing is the social camera [18]. These studies imply the value of a collective online folder for the photo experience for small groups, especially after meaningful events.

However, targeted sharing to a small group poses problems, as the group formation may vary drastically at different events. SNSs generally face problems with the balance in user-generated content, with massive consumption but little creation [19]. However, creativity can be motivated by giving users a sense of social interaction and connectedness and by lowering the threshold of sharing as the work on social user experience suggests [24]. Social networking services can add collective value to the content by facilitating the sharing of personal media, thus offering a sense of community [12]. Captured and shared content facilitates social interaction and collaboration related to content, and both enrich the content and can lead to new content types and entities. The social user experience happens in a social context, where users and their presence define the actual interaction.

Väänänen-Vainio-Mattila et al. [24] defined factors for social user experience. Curiosity, learning, self-expression, suitability of content and functionalities, completeness of networks, and competition were identified as the motivational drivers for social user experience, which was extended in [18, 24]. The findings presented in this paper contribute to the understanding of content-mediated social user experience with individually recorded video content contribution for automatic video remix creation as well as automatic video remix sharing in small event-based groups in three different event contexts.

3. THE STUDY SETUP

Our research approach is that of constructive design research [27], in which the phenomenon is approached by giving a designed artefact to the study subjects. By the behavior and the feedback of the study subjects the artefact is developed further. In this study, the back end of AVRS, namely the remixing feature, was utilized as the artefact. Artefact was developed further based on the findings of the study. The study was part of user-centered design process aiming to understand the usage patterns of collaborative mobile video remixing and additionally to collect knowledge of the user behaviour in the video capturing events for building the AVRS client, front end of the system. More specifically, this study aims to solve the following research goals:

1) What are the motivations of capturing and sharing mobile video content for collaborative remixes?

2) What type of requirements do the different events bring to capturing and remixes?

3) How do the users perceive the collaboration after seeing the end-product, namely the remixes?

4) What type of features should be implemented in the AVRS client application?

Methodologically, the study was organized partly as observed field trial and partly as a qualitative interview study. Observation was done by the researchers in the video capturing events to identify the habits of video capturing that the client application has to support. A total of 30 participants were selected for the study. Fourteen of the participants took part in the video capturing events and sixteen participated as video viewers. All of the 30 participants watched the videos and were interviewed in the final sessions.

The Automatic Video Remixing System (AVRS)

The automatic video remixing system (AVRS) is a fully automatic, collaborative video remix creation system. It was introduced in [23], where it showed that it can be an invaluable tool in reducing the burden of generating video remixes, compared to manual remix creation. This becomes even more prominent in a collaborative environment in which content from multiple users needs to be processed. The quantity of content increases, resulting in the increase of time required for making manual remixes [22]. Figure 1 introduces the four logical phases of the collective video remix creation.

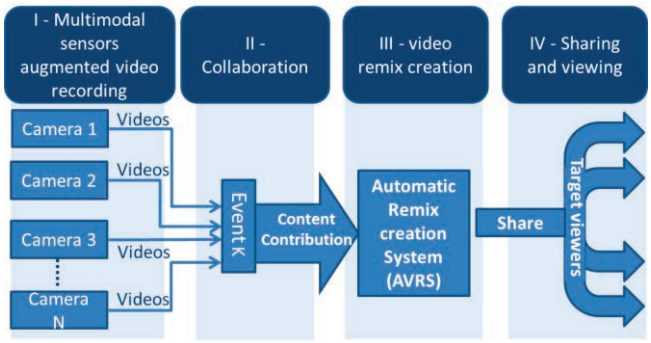

Figure 1: Process of creating video remixes from a user's viewpoint

The automatic remix creation consists of essentially four logical steps (Figure 1). The first step is the multimodal sensor augmented video recording. This phase consists of recording videos that are augmented with multimodal sensor information (compass, accelerometer, and GPS). The second step consists of collaboration for generating the remix. This phase requires collaboration by multiple users who recorded content at the event and contributed their content for making a video remix. The collaboration mechanism consists of creating an "event" in the AVRS system. The "event" acts as an identifier for collecting the content contributions, which are envisaged to be used as input for generating the video remix. The event identifier is used as a logical common repository for all the related content contributions. The other users at the event need to join the created event. Subsequently, the users select the content from the list of recorded content to be uploaded to the AVRS system.

The video remix is generated automatically by the AVRS system after the predefined minimum content availability threshold is fulfilled. The third step is video remix creation. This consists of generating the automatic remix from the contributed content. The AVRS system has been improved compared to the previous version [23]. The improvements relate to the use of the best quality content from the available content in the video remix, the inclusion of relevant views from all of the available views, and changes of views depending on the audio rhythm, aiming for a more interesting remixes. The final step is sharing and viewing the video remix generated in the previous step. This step signifies the fruition of all the effort that the multiple users have invested in making a video remix. Sharing of the video remix with the audience of interest is an important step for user satisfaction, since it enables viewing of the video remix by the intended audience. Sharing the content to the server can be handled either instantly or after the event.

The AVRS system enables people to collaborate by allowing them to form spontaneous groups based on a certain event. As an addition to the small group sharing in the previous work, this work gives a perspective about the event-based small groups. For public events, anyone attending the event can join this collective effort, even if the users do not have each other's contact information or know each other. The remix includes multiple video views over a common audio background track, which represents the common audio scene at the event. The audio source is selected based on the quality of audio. The rhythm of switches between views is in accordance with the audio tempo to allow new views in the video remix.

3.1 Participants and Method

We recruited 30 people living in (removed for blind review) for this study, 13 males and 17 females, with ages varying from 20 years to 50 years. The average age was 28.6 years. Among these 30 people, 21 were students, while the remaining nine worked in different fields. Fifteen participants worked or studied in an ICT-related field. Nine had some previous experience in video editing. All participants received a small reward.

This study had two phases. The first was a video capturing session that included a briefing about this study. In the video capturing sessions, researchers took part and observed the events and how participants captured the videos. The second phase was the final interview session with a debriefing. Fourteen participants were involved in both phases, as video takers at the events and as interviewees. Sixteen participants took part only in the interview sessions as video material viewers. This selection was made to reflect the real users' situations and that of the interest groups, in which only some of the video remix viewers had actually attended the related event.

The AVRS concept in full was presented to the users as a storyboard that explained the functionality in a real-use scenario (Figure 2).

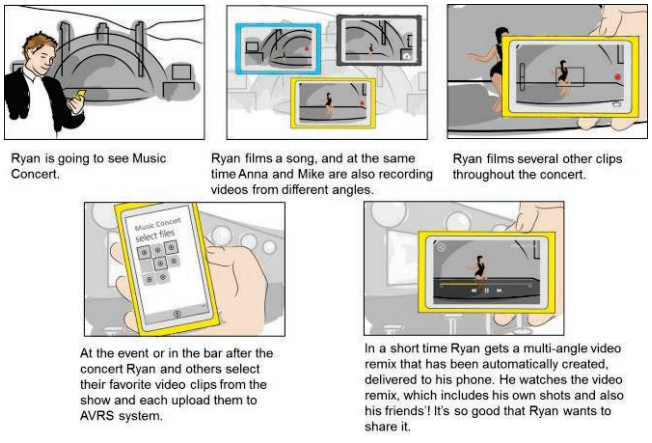

Figure 2: Concept of AVRS. The concept slides were presented to the participants in the interview sessions.

Figure 2 shows the concept slides that were shown to the users in the interview session to describe the functionalities of the concept. This phase of study was organized for collecting feedback for the AVRS client implementation in order to discover the features the application has to offer on the time of video capturing. The actual concept was introduced to participants using a concept slides, as the actual concept requires minimal interaction during the video capturing in the events (Figure 2). Similar approach, but using low-fidelity prototypes has been introduced in work by de Sa et al [2]. The interview evaluation was complemented by a user experience questionnaire. Comparison of the automatic and manual remixes is beyond the scope of this paper, since it will require detailed treatment to present the results and discuss the user experience implications on the system requirements.

In the final interview sessions, semi-structured interviews were carried out, consisting of individual session and group sessions (of two to three people). In these interview sessions, the participants watched and evaluated three video clips. The first clip was a randomly selected raw video clip from the event that was not edited in any way. The second clip was a manual remix made from the raw video clips recorded by the trial participants in phase 1 (made by one of the authors). The third clip was an automatic video remix clip of the raw video clips recorded by the trial participants in phase 1. Remixes 2 and 3 were shown in a random order. The users watched one raw clip, two video remixes, and the AVRS as a concept to get the idea of the remixing functionality and its capabilities.

The final interviews were audio recorded, resulting in a total of almost 90 hours of raw interview data. Users were not informed beforehand about how the remixes were made. After the remixes were shown and the user experience surveys and interview questions were answered, we revealed that one of the two video remixes was automatically created. For each interview, the responsible researcher wrote notes. Data was then analyzed by using the Affinity Diagram approach electronically [6].

3.2 Video Capturing Events

Trial participants were divided into groups of video capturers and viewers. Three different events, each belong to a different event type, were organized for this study. The different event types were sport event (an Ice Hockey match), a music concert and a formal event (a doctoral dissertation defense and dinner party). Each of these events brings wide variation in the content capture situation (Ice Hockey event was in big stadium, the music concert was in a small club and the doctoral event in a more private venue), the composition of the audience and the parameters for determining the salient features to be included in a video remix.

The chosen events represent a diverse contextual situation, and hence it was considered a good choice for discovering new user requirements. While the video capturers attended the organized events as well as the interviews, viewers took part only in the interview sessions. The choice of the specific events was influenced also by practical considerations like ability to recruit users who may be actually interested in recording in the events and also have interest in the content. These practical constraints in user recruitment did not allow including niche events like exhibitions, museums, trade fairs, etc., The study was designed in that manner in order to simulate the real usage of the AVRS concept, whereby only some of the users capture videos at the events. This assumption is also valid for user-generated content consumption in general. Users who record or create content share it with others, and in many cases, the viewer group is more numerous than that of people who record or create content. This design gave us the possibility to study the differences in the ratings between the groups.

In the video capturing events, users were instructed to capture videos at specified times using all the devices together and to capture more at will. After the events, the smartphones were collected from the users and the material was uploaded to a server.

In this study, the users did not complete the uploading part. Instead, they saw the end result remix in the final interview sessions. In all of the following events, users captured videos with three Nokia Pureview N808 smartphones and additional N8 smartphones.

Event 1: Finnish national league ice hockey game at Hakametsä ice hall in Tampere. At the event, six participants and one of the researchers shot videos. Three of the participants knew each other beforehand. In addition to the capturers, six viewers watched the material during the interview sessions.

Event 2: Music concert held at a local venue, called YO-talo. One of the researchers' band performed at the event. Five participants and one researcher captured video material at the event and seven viewers took part in the final interview sessions.

Event 3: Doctoral defense held at a local university. Three participants shot the videos at the event. All of them were part of the same project group and knew each other well. They also knew the doctoral candidate. Three viewers, who knew the doctoral candidate, took part in the interviews.

4. RESULTS

The user study findings are presented in a similar order than the processes described in Figure 1. First, the factors that motivated people to capture and share video content at the specified events are presented. Second, the requirements that different events bring to the remixes are discussed, and the benefits of using the system are assembled. Third, the factors that affect the ownership of videos and collaboration are presented. In the end, user needs for the remixes are discussed and finally complemented with the requirements for the implementation.

Generally, users who attended the events and captured videos saw the concept as handier than those who only watched the videos. The concept idea was described as fun and easy in the interviews. The majority of the users stated that the automatic end result, the video remix, was of better quality than they would have been able to make by themselves with manual editing. Nine of the participants had some experience in video editing and even these participants saw value in the automatic remixing. The ease in producing the remixes from many video sources was appreciated as well as the quality of the automatic remix. *"I have masses of photos and videos that are only on my phone, but whenever I happen to see them, they evoke memories!"* (P26). *"It was quite exciting. I could not believe that computer could end up with such a good result."* (P17).

4.1 Self-Expression and Connectedness: Motivations for Capturing and Sharing Raw Video Material

The study investigated the motivations to capture and share video material in the events. The following section describes the findings related to content capturing and sharing. The AVRS concept was intended to add reciprocity and a feeling of social presence and awareness [24] to the video capturing. When you contribute to the collective video remix, you get others' content in return. This also motivates users by providing extra material and viewpoints in addition to one's own recorded content, which is obviously captured from the same spot where the capturer experienced the event, thus adding a feeling of connectedness with other capturers [18]. Others' materials can enhance their own captured material. *"Single capturer cannot take all the angles and in some events move at all. It can be more interesting with the multiple cameras. It raises the watching experience"* (P21).

Capturing and sharing videos was stated to add a social dimension to the events and interaction mediated by the content afterwards. Social dimension motivates users to participate and contribute content [15, 18] Ease of creating the remixes was stated to be the main benefit of using the service. Videos tend to be left on the personal devices, even though the intention was to share them. Automatic remix creation provides a channel to the content. *"Videos and photos are shared in FB in a closed group or by e-mails. It might take two years in some events." (P16).*

Figure 3 gives an overview of the social user experience with the service being studied. Figure 3 shows that statements related to the sociability of the AVRS got high ratings regardless of the event. Users saw the remix as a social effort and they were mainly willing to be social with the other users of the service.

Statements on a Likert scale (1=totally disagree to 7= totally agree) Average (standard deviation in brackets)	**Ice Hockey N=12**	**Con-cert N=12**	**Disser-tation N=6**	**Total N=30**
This concept idea would make it easy to share videos with the people who attended the event.	6.50 (0.52)	6.33 (0.78)	6.00 (0.89)	6.33 (0.71)
This concept idea would make it easy to share videos with the people who did not attend the event.	6.42 (0.79)	5.50 (1.00)	5.50 (1.22)	5.87 (1.04)
I'm interested in knowing whose video clips I'm watching.	4.75 (1.48)	5.00 (1.71)	5.33 (0.82)	4.97 (1.45)
It is fun to see videos including content captured by other users	6.17 (0.58)	5.75 (0.87)	5.83 (1.17)	5.93 (0.83)
Overall grade for the concept idea that was presented?	5.83 (0.52):	5.75 (0.62)	5.83 (0.72)	5.80 (0.66)

Figure 3: Sociability of User Experience with the AVRS

As Figure 3 shows, the overall grade for the concept (N=30) was an average of 5.83 on the Likert scale of 1 to 7. Figure 3 gives an overview of the ratings that the different groups gave to the concept. Participants stated that collective video remixing and knowing that there will be captured content from others allows them to be creative and express themselves. Self-expression and creating users' own identity is also a driver of the social user experience in the previous work [24]. Figure 3 expresses the difference in the nature of the events. The ice hockey match was seen as a mass event, which could be of interest to those who had not participated. Higher rating on the "This concept idea would make it easy to share videos with the people who did not attend the event" statement suggests that concept was seen more convenient for events like that. On the other hand, dissertation was more intimate event for a smaller group, which can be seen in

the statement "I'm interested in knowing whose video clips I'm watching.", where the dissertation event got higher ratings.

AVRS concept can help users in being creative in their video capturing. Knowing that the main focus will be shot by multiple capturers allows users to freely express themselves and capture the unexpected and interesting things happening in the background. *"An option is to personalize the stuff for yourself, shoot everything where other cameras do not point. You can see, for example, what your own friendly group or celebrities in the concert did in the audience!" (P26).*

Being a part of the video collective was stated to be a motivating by many of the participants. Content from many capturers was stated to result in a better end-product, if the remixing was handled automatically. Surprisingly, automatic remixes were stated to be artistic and varied. The automatically created remixes from many sources can raise the quality of YouTube live videos. *"It can give very diverse remixes, by combining the stuff from many shooters. Professionals can do it, but to hobby shooter it can really be supportive."* (P21). *"Your own material will be better when others' material is automatically added"* (P7).

Fundamentally, capturing videos at special events can shift the focus from the enjoyment and experience of the event. Current design of AVRS aims for minimal interaction with the client during the video capturing. *"I don't usually like to shoot videos. It takes something away from the enjoyment of the gig" (P21).*

4.2 Requirements of the Different Kinds of Events

The study investigated the requirements that different event types bring to the AVRS concept. The AVRS concept was stated to be effective in offering additional amateur video content to be mixed with the professionally captured content and thus adding new angles to the experience. Different kinds of events where the videos are captured by event attendees and amateur capturers impose various requirements for the video remixing system. The following section describes the requirements for the different event contexts.

Sporting Events: Requirements for a sporting event, such as a hockey game, are built around the earlier habit of watching games on television. Earlier experiences dominate the perception and anything different can feel wrong at the beginning. Sporting event broadcasts follow certain conventions that must also be followed in the remix. For example, conventions do not allow 180-degree turnovers during the game. Also certain highlights such as goals and player information are familiar and their absence lowers the perception of the remix quality. Users wanted to have relatively long periods without any switches and smooth camera changes, even though the pace of the sport may be fast. Reactions and the feeling of an audience presence is important in sporting events that fundamentally rely on spectators. *"If somebody manages to capture something special, for example, in the audience, the audio track can still follow the game at same time*" (P25).

Music Concerts: The concert setting was the event type that was also covered in the earlier work by Vihavainen et al. [23]. In a concert setting, automatic video remixing can bring extra value to the classic mobile video shots. In the interviews, the users very clearly indicated that expectations of the live videos shot with mobiles were relatively low, and users can easily be surprised positively by using material from multiple sources. Users can get the viewpoint of others in the audience. *"Since your own seat may be fixed and cannot move freely, it will be interesting to see content from other viewpoint"* (P12).

It was clearly important to have the overall atmosphere included in the video, namely the audience and the venue. Concert settings give freedom to the camera changes, but there are still parts that can raise frustration, if they are accidentally cut out of the video remix. *"It was pleasant to watch. The camera changes were smooth, and it didn't feel like randomly shooting around. The end was still stupid, because it cut away the part where singer was about to give a speech. If that happened to the video of a band that I'm a fan of, it would be irritating!"* (P19).

Formal Events: Formal events such as big celebrations and work- or study-related events have different requirements for the video capturing and what viewers expect of the video remix. Events like a dissertation presentation include a lot of speech, during which the speakers are sitting still and comprehension of what is being said is important. *"Sub-titling should be included if the audio is not good. Audio and spoken words are so important"* (P28).

Formal events pose problems for the video capturers. Video capturing must not disturb the flow of the event and has to be unobtrusive. Balancing between the formality and informal parts is important regarding the audience for the remix. At the formal events, it is important that the main persons are in their main roles in the remix. An absence of the main persons lowers the feel of quality of the remix. *"It would have been possible, if the camera was on a tripod or remotely controlled, to avoid making a lot of fuss. That would not have disturbed us that much"* (P27). *"If the whole dissertation is remixed, it must include dialogue between the candidate and the opponents and the presentation. It has to be formal at that point"* (P25).

All of the studied event types shared certain similarities in the requirements of the video remix. In all of the studied events, camera changes needed to happen for a reason or to support storytelling to get the best experience. The reasons and the way of storytelling are different in the various contexts, and the storytelling has to follow the conventions of the event type. For example, the camera should not change to a long shot or bird's-eye view when something is happening. Users stated that the concept would be useful at events that are not captured professionally. In the events where audience has a significant role in building the atmosphere, the audience should be audible and visible in the remix also. *"I would like to hear the sound of supporters. You expected that the audience would explode into screams when goals comes. (P1)".*

Additionally, at the events where there are lots of things happening at the same time and people are scattered around, it would be useful for mediating the events to those that are on different locations. *"For the events that are not recorded in other ways. Junior league football matches or special events like the one where <removed for the blind review> United Supporters team got a promotion to the fifth division!"* (P11). *"Festivals are relevant. Things happen in various stages, so you want to see what happens elsewhere. You shoot one gig and get other in return!"* (P12).

4.3 Collaboration and Discovery: Ownership of the Remixes and Videos

The study focused thirdly on the factors that affect the ownership of videos and how the automatic remixing enables collaboration. This section describes how the collective remix can enable

collaboration. In automated video remixing the users do not actually collaborate in the remix making, but instead they collaborate as the content creators when they allow their videos to be used in the resulting remix. Videos are captured collectively and therefore the system differs from the previous collaborative video systems. This creates fundamental difference, since the collaborative work is mostly automatic.

Understanding the audience the remix can reach and possibility to limit it were important for the users. Even though content such as large-scale festival videos can be public, all of the shared content is not perceived as widely public content. Small group sharing and limiting the audience are important. Even at the mass events, some people were interested in seeing the "viewpoint of my friends" or a similar limited edition of the video remix, consisting of recorded content only from a subset of the event participants. Participants saw many possible uses for the automatic remixes. The end product would be useful as a way to combine material from social and family events. The end product could be handed out as a gift to friends and relatives, or as a bigger group memorabilia. *"I would take videos and photos of my godchild and then make the remix on the first birthday"* (P19). *"I got invited to an event where I see people I haven't seen in three years. This could give the whole group a memorabilia of the event!"* (P18).

Figure 4 describes the ratings related to the video content sharing from the user experience questionnaire. Figure 4 shows users gave relatively high ratings to the statements related to willingness to share their video content to the service. Answers are divided into capturers and viewers at all events. The ratings were relatively high, regardless of if they participated in the video capturing or just watched the videos.

Statements on a Likert scale (1=totally disagree to 7= totally agree) Average (standard deviation in brackets)	**Capturers N=14**	**Viewers N=16**	**All N=30**
I would allow my personal video clips to be used on the remixes.	5.65 (1.62)	5.31 (1.25)	5.50 (1.46)
I would allow others to edit raw video I have captured.	5.76 (1.64)	5.46 (1.05)	5.63 (1.40)
I would like to do the video remixes between more private or closed group (group of my friends or family for example).	6.24 (1.09)	5.92 (0.95)	6.10 (1.03)
I would give the videos I have captured to use in the system for making the video remixes.	5.06 (1.82)	5.38 (1.26)	5.20 1.58)
I'm interested in seeing in which remixes my clips end up into.	6.12 (1.45)	6.46 (0.66)	6.27 (1.17)
I'm interested in seeing who sees my video clips in the remixes.	5.35 (1.50)	5.31 (1.38)	5.33 (1.42)

Figure 4: Content sharing related statements on the AVRS user experience questionnaire. Comparison is made between the capturers and viewers of the content.

Ownership of the videos was not important for the participants, but getting recognition for what they had made was, as high ratings in the statement "I'm interested in seeing in which remixes my clips end up into." suggest (Figure 4). In the user study, the participants were willing to hand over the video material for this kind of service. Since the video material was shot at the request of the users, obviously it makes it more impersonal, and the case will be different in real life. Occasionally, concerns regarding the ownership of the recorded content were raised. The concerns were about the presence of copyrighted content in the recorded material or if the video remixes were used for commercial purposes. Unlike the previous studies by Vihavainen et al. [22, 23], some users wanted credit for their material in the remix. However, it was also stated that there are other channels of creating and sharing the video if you want to make it your own work of art. *"The shooters name or tag should be visible in the video"* (P11).

Figure 5 shows how the answers to statements related to video sharing differed between the different events.

Statements on a Likert scale (1=totally disagree to 7= totally agree) Average (standard deviation in brackets)	**Ice Hockey N=12**	**Concert N=12**	**Dissertation N=6**	**Total N=30**
I would allow my personal video clips to be used on the remixes.	5,83 (1,03)	5,17 (1,31)	5,50 (1,86)	5.50 (1.46)
I would allow others to edit raw video I have captured.	5,67 (1,61)	5,67 (0,90)	5,50 (1,96)	5.63 (1.40)
I would like to do the video remixes between more private or closed group (group of my friends or family for example).	5,50 (1,17)	6,42 (0,67)	6,67 (0,83)	6.10 (1.03)
I would give the videos I have captured to use in the system for making the video remixes.	5,08 (1,83)	5,00 (1,08)	5,83 (0,79)	5.20 1.58)
I'm interested in seeing in which remixes my clips end up into.	6,75 (0,45)	5,75 (0,72)	6,33 (0,49)	6.27 (1.17)
I'm interested in seeing who sees my video clips in the remixes.	5,42 (1,38)	5,17 (1,17)	5,50 (0,81)	5.33 (1.42)
Other users' video clips were interesting	5,75 (0,75)	5,08 (1,44)	6,00 (0,91)	5,53 (1,28)

Figure 5: Content sharing related statements on the AVRS user experience questionnaire. Comparison is made between the different event groups.

As figure 5 suggests, participants were less willing to share their video clips in the concert setting. Partly because they were not familiar with the bands performing, which also show in the lower ratings to the statement "Other users' video clips were interesting". Sharing the video remixes between smaller target group was more important in the concert and dissertation setting,

as ratings to statement "I would like to do the video remixes between more private or closed group" suggest. Mass sports event are fundamentally open and broadcasted events. However, in such mass events, users are particularly interested in seeing if their own video clips reach the remix, as high ratings from ice hockey event group in statement "I'm interested in seeing in which remixes my clips end up into" suggests.

As the users were willing to share their video clips, they at the same time felt connection to the material they had captured. High ratings on the statements "I'm interested in seeing in which remixes my clips end up into" and "I'm interested in seeing who sees my video clips in the remixes" suggest, that users were willing to know how their own video clips were used in the remixes.

As the content is uploaded to the server for the remix purposes, it offers an opportunity to find and store content afterwards, thus adding the possibilities of content discovery [18, 19]. *"I could add social dimension to the concert if the whole group of friends would shoot videos and share. Even more if another friend has been on the same gig" (P25).*

Participants shared the fundamental idea that the contributors owned the remix all together, even though their own clip did not end up in the final remix. The experience of creating the video remix was stated to add collaboration to the user experience, even though the creators may not know each other [18, 19]. They wanted the service to be responsible for the legality of the material in the end. The copyrights should be owned by all the users, for example, if the remix goes public in news services. *"In a way, the shooters own it together, but I'm not sure if they really have the license or copyright to the artwork. You cannot expect that basic users take care of the copyrights"* (P8). *"The videos are shot everywhere, but it is kind of mixed up situation with the copyrights. If the remix is made from a commercial concert, it would be good if the service could take care of the legal stuff"* (P16).

4.4 Design Implications for Collective Mobile Video Creation

Finally, study gathered a list of requirements of the system from the user feedback. These findings were analyzed and elaborated as design implications for similar solutions. They are presented in the following section.

Automatic remix creation, the pro-activity of the concept and level of user control raised concerns amongst participants in this study. The level of user control is previously addressed in the work by Vihavainen et al [23]. The first concern raised by the users was that interesting parts will be left out of the video remix, and the second concern was that something would be published unintentionally. Combining automation and user control was stated as the most efficient way to end up with a sufficient remix result. Finding the right balance between automation and user control and user efforts determines how useful and pleasurable to use the AVRS solution is.

As an approach to control the content in remixes, two prominent methods were discussed in the interviews: automatically detecting the important parts and detecting them with the help of user feedback. Two important factors define the need for the annotations: identifying important clips and the clips that can be left out of the remix. For making the annotations, there are two possible ways to add the information to the video content. The first possibility is when the raw videos are watched. The second possibility is at the time of watching the video remix. Annotations that are made at the time the videos are shot, using simple interactions, were said to be most time efficient. Making annotations afterwards is hard and time consuming, as well as non-motivating. Making annotations must not disturb the video capturing at the events. *"Users should be able to mark the interesting moments of the event when capturing the videos. Users should be allowed to be lazy"* (P1). *"It may be that you have only one hand free for the video shooting, so it has to be that easy"* (P24) *"Maybe with simple interactions where you select interesting moment and want to see more: more camera angles. Here's a concept from skate boarding: you capture hours of shots and when you get the perfect shot, the cameraman puts hand over the lens and then you can see the mark when you watch the clips"* (P4).

The number of video capturers at a specific time and to a specific direction offers a data to detect the most important and interesting moments, Detecting the moments that gathered collective interest is an interesting development area to research further. *"If there is something important shot from different angles, it will most likely be important. (P3)"*

Current design of AVRS aims for minimal interaction with the client during the video capturing. Participants gave ideas on how the system could give help in the moment of capturing the videos. They wanted a system that could work as a real-time director of the multiple cameras. For example, it could tell how many cameras are recording certain view. *"If the picture is low quality due to light or shaky, it would help."* (P21). *"Give each camera certain roles. If someone is covering one of the important things, the other people can cover other things"* (P28).

Detecting the most interesting parts automatically by gestures, laughter, and funny faces was suggested to be a promising approach to detect the interesting parts of the clips. Additionally, automatic selection of the close-ups and detailed shots could make the remixes better and more interesting. Additionally, the system could exploit face recognition in order to make sure that there is video from all the important persons from the event. *The shooters could have a common sense of who are the main persons. Maybe first by tagging the faces and then the system could tell that at the moment no one is shooting the doctoral candidate for example and show the red light"* (P28).

Participants wanted someone to be in charge of the final remix in situations like weddings and formal celebrations. For example, in the dissertation, one of the contributors could be nominated as a director. Content must be previewed by the concerned people for privacy and emotional reasons in such events. Making selections and annotations with the help of crowdsourcing was seen as a promising approach, as well as democratic principles to decide on the remix publishing. Users wanted to give different parameters to create personal and iterative remixes. The motivation behind this was to be creative and test different combinations. Users additionally stated that they like the idea that remix creation can introduce randomness to the remixes intentionally. *"If you could mark the stuff on the process and the remix could evolve every time.* (P19). *"Allow easy way for people to be creative. If they have a chance to influence the result they feel more related to the remix. Implement it like a lottery machine and varying video remixes come out. You may have few options: funny, intense more meditative etc. try different things with the system and see the results."* (P27)

A Fundamental problem was stated to be the formation of a group in the events, where capturers do not know each other. Collaborative video creation solution has to offer features for initiating the video collective in the spot or include features for pro-actively initiating it. AVRS allows users to form "collectives" related to events based on the spontaneity. Spontaneity itself is a corner case in the video creation, since the events can also be planned beforehand, e.g. formal events.

5. DISCUSSION

This study addresses issues related to capturing and sharing video content within event-based groups. The results show that different kind of events and group formations require different functions from the remix. Sports events require following the conventions and including the audience in the remix. Concerts require multiple views of the performers and views showing the venue and atmosphere, whereas formal events require including the main persons and full comprehension of their speeches. Users were satisfied with the quality of the remixes in the music and dissertation events. At the ice hockey event, AVRS did not support the user needs as well.

In terms of the social user experience, the findings of the study relate closely to following categories: self-expression, connectedness, collaboration, and discovery, which are identified in previous work [18, 19, 24]. AVRS supports connectedness by offering a feeling of being related to others who took part and captured videos at the event and shared memorabilia with them. AVRS supports self-expression by allowing a user to give one's own content to the remix and thus be a content creator. It supports collaboration by creating a group memento from the event in collaboration with the group. And finally, it supports discovery by enabling finding and seeing new videos and thus new viewpoint of the events.

Getting acknowledgement if the contributed content is visible in the remix brought out variance in the current study in comparison to the previous study of AVRS in the large-scale music festival scenario [22]. Participants were clearly interested in seeing whose content has reached the remix. The previous study included users who did not want any acknowledgement in the final remix. However, in this field study, users were interested in seeing if their video ended up in the final remix and to know who contributed the other video clips. One reason for this could be that some participants knew each other before the study, and consequently they were interested in the contributions of others but also to know whose contributions were included in the final video remix. Juhlin et al. [9] have introduced a research agenda for video interaction and in their work one of the goals is to understand the value and utility to the users. Results are promising in a sense that automatic remixing is obviously needed for the collaborative videos.

An obvious limitation in the study setting was the actual spontaneity of the groups. All the participants were invited to the study and explicitly instructed to capture video content. As the study setting defined the group to share the video content with the situation is fundamentally different to a real situation where the group should form spontaneously or even needs activity from a certain user in initiating the group. Pro-active features in the application can however ease the group formation by initiating the group based on the location and the event. The implementation of a client in any collective video creation solution needs to address this issue.

Findings of this study suggest that users are willing to hand their video material to create automated remixes, even with the strangers. A group formation on the events with the strangers however is an area that needs further studies, since in this study the groups were instructed to capture videos. Thus the actual spontaneity can be criticized. The study was completed with a population of 30 users, so the validity should be validated with a broader population to have more statistically robust results and to further investigate the differences between the groups. For the future research and development, tools for iterating the remixes would allow more flexibility in the end remix creation. It was the most desired new feature in the study.

6. CONCLUSION

We have presented a user study on a concept that enables user groups to create automatic mobile remixes in different event types. The most prominent findings of the study imply that people are motivated to use such a service as well as contribute to the service by sharing their personally captured video content. The automatic video remix creation was seen effective in giving a good presentation of what happened at the event, and resulting interesting remixes. Users were motivated to capture and share their content because they wanted to access others' material and an interesting final remix in return. Taking part in the community of the event video capturers motivated the users since they felt connected and related to other users recording and sharing videos in the event. Automatic video remixing was stated to ease the pain of editing videos. AVRS was stated as giving a channel to share the videos. Sharing the collectively created remixes was stated as offering an easy and efficient way to have memorabilia of the events. Evidently, the group formation in the event is a challenge that AVRS aims to solve. AVRS aims to offer pro-active platform for enabling the spontaneous video capturing and utilizing the video clips in a collective video remix.

Of the three event types, the AVRS system was considered to support users, especially at music concerts, followed by formal party events and sports events. As an addition to the previous findings in similar solution in festival event setting [22, 23], the results suggest that AVRS as a solution can be expanded to other event types as well. Combining automatic approaches of selecting the most interesting and high-quality sections of the video with user annotations was seen as an ideal way to make best possible remix that would remove the shortfalls in the current system.

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Six Enablers of Instant Photo Sharing Experiences in Small Groups based on the Field Trial of Social Camera

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Abstract. Mobile photo taking and sharing has become a frequent leisure-time activity for smartphone users. This paper presents a field study of a mobile application called Social Camera, which enables instant sharing of photos within small groups. The application enables collaborative creation of photo collections with shared folders in the cloud and instant connection through the folders and photos. Social Camera was evaluated using four groups (altogether 17 users) in a field trial. The results reveal six enablers of instant photo-sharing experiences within small groups: sense of connectedness and social awareness, presentation and expression of self, lightweight and surprising interaction, collective photography, documentation of experiences, and finally, privacy and user control. This work gives design implications of these enablers for photo-sharing applications.

Keywords: Photo sharing, user study, mobile application, social media interaction, user experience, design.

1 Introduction

Media and entertainment online relies ever more on user-generated content. Social networking services [1] such as YouTube[1], Facebook[2], and Flickr[3] are built on video and photo content from the users. The "interestingness" of content depends on the freshness of the content, the person's relation to the content, personal nature of the content, and whether the content is actually targeted to the receiver [2]. Users currently have solutions for sharing their photos publicly in social networking services (SNS) but lack dedicated solutions for instant sharing within small groups. To this end, novel ideas to support pleasurable user experiences are needed. The private group setting and instant sharing are the key differentiators from conventional

[1] Youtube, www.youtube.com, accessed 1.8.2013, [2]Facebook, www.facebook.com, accessed 1.8.2013, [3]www.flickr.com accessed 1.8.2013

photo-sharing tools such as Facebook and Flickr. In our current setup, user's photos are directly uploaded to a shared album, which is accessible to relevant users [3, 4].

This study examines social user experiences enabled by design solutions for small-group photo sharing with mobile devices. A prototype implementation of Social Camera aims to combine the experiences of remote sharing and collocated sharing into a new way to share photos instantly. The goals of this study are 1) to evaluate the implemented Social Camera prototype, 2) to identify habits of photo sharing within the intimate group, 3) to observe users' interactions with each other during the trial period using the prototype and not using it 4) to identify the needs and wants of the groups that the implementation actually has to fulfill. The results are significant in the area of human-computer interaction since the online sharing of photos in small groups remains a less-studied area, and dedicated solutions for instant sharing with a small group do not exist. This work contributes to the area of social user experience design by introducing enablers of social experience in small-group sharing.

2 Related work

Development in photo-capturing devices and channels for sharing the content has created a new culture of instant photo sharing. The new culture of digital photo capturing and sharing has also gained interest and sparked rich research in the human-computer interaction community. Kirk et al. has named the whole process of photo taking "photowork" [5]. Frohlich [6] has introduced a model of four categories in the photowork process: co-present sharing, remote sharing, archiving, and sending. The most essential phase needing support in the current online world is the sharing of photos. Data transfer with broader bandwidths and development of cloud computing technology allows new solutions for archiving and sharing photos outside the hard disk and physical drives [7]. The cloud technology has become available for the public audience only recently, by services such as Dropbox[1]. An emerging design trend in mobile photo sharing is automatic upload of photos to a cloud server. Studies by Lucero et al. [8] explore the Image Space application, which allows automatic upload of photos with location tags and sharing the photos within a limited community. A similar cloud-based application called Image Exchange is introduced in work by Vartiainen [9].

As a basis for the design of the small-group–photo-sharing application, several studies were utilized to give background. Previous work has identified a problem in small-group sharing especially after the events a group has attended or trips a group has taken together [10]. Users do not have dedicated services and habits of distributing the photos. Therefore, distribution takes time (and the photos have the greatest value right after the event). Additionally, previous studies suggest that people are willing to share personal content in private circles such as family or close friends [10, 11]. Close-knit groups have needs for demonstrating the group identity and for collectively managing content [10]. A study by Miller and Edwards [12] introduces a culture of "snaprs," photographers that base their photography on sharing with the online community, in the mentioned case Flickr. Snaprs described habits of downloading pictures of others as a part of their own photo collection, where "kodak

[1] Dropbox, www.dropbox.com, accessed 1.8.2013

culture" wanted to have a solution to share to the limited group only [12], which suggests that there is a need for shared or collaborative folders amongst the small groups. Photo sharing using camera phones as the capturing device and the sharing platform is a widely researched area. Frohlich et al. [6] handle photowork on two dimensions: temporal and locational. Photo sharing is handled either instantly or after some time, collocatedly (on the spot) or remotely. Traditional photography requires a certain time gap between the photo capture and the sharing. Digital photography has made the time gap narrower. According to the Kindberg et al. taxonomy [13], there are affective and functional dimensions in photo sharing: mutual task and experiences with the collocated users and remote tasks and shared experiences with those who are absent. Kindberg et al.'s [13] study of camera phone users introduces a taxonomy of six reasons for image capture on a camera phone: individual personal reflection, individual personal task, social mutual experience, social absent friend or family, social mutual task, and social remote task.

The definition of storytelling includes sharing of multiple photos with a textual or oral commentary attached. Collocated sharing and storytelling are the focus of Van House et al.'s work [14, 15, 16]. Van House et al. [15] introduced three motivations for social use of personal photographs: constructing personal and group memory, creating and maintaining social relationships, and self-expression/self-presentation.. Balabanovic et al. [17] have identified patterns of photo-driven and story-driven photo sharing. Sharing with the people who were present in the capturing moment is referred to as "reminiscing" [13, 22], and telling about the event to those who were not present, "storytelling" [6]. Content consumption and creation are often not in balance in communities that are built on user-generated content [19, 20]. Most of the users are eager consumers of content and less willing to produce or especially share the content. However, content production can be motivated by giving users a sense of social interaction and connectedness.

Research on social user experience focuses on the social context of the products, where the presence and actions of other users creates the user experience. Interaction, collaborative creation of content, and reciprocity are essential for the social user experience. Social dimension in the interactive products as a factor of user experience remains a less-studied area. The social user experience is built on the social context in which other users and their presence define the actual interaction. In their study of socially used web services, Väänänen-Vainio-Mattila et al. [20] explored social user experience as UX with services that support social activity through their functionality. The research identifies curiosity, learning, self-expression, suitability of content and functionalities, completeness of networks, and competition as the motivational drivers for social user experience. The study findings presented in this paper contribute to the understanding of social UX with photo sharing in small groups.

3 Design and Field Trial of Social Camera

The design process of Social Camera started with two user studies in 2011 [3, 4, 10]. Relying on the findings from these two studies, the implementation of Social Camera application was completed. Prototype implementation Social Camera aims to combine the experiences of remote and co-located sharing into a new instant way to share

photos. The research involved three aspects of interaction design: understanding the users, prototype design, and evaluation [23]. The initial studies related to small group photo sharing raised design framework for the system. It was found out that: 1) small groups have problems in sharing the picture content from many devices between the group, 2) people have suspicions over sharing the data in social media or social networking services, because they are not willing to risk losing their control over their photos 3) people use web folders and cloud services such as Dropbox, although they might not be implemented for sharing and storing photos taken with smart phones 4) the event pictures tend to be most interesting right after the event they are shot into 5) people would like to have dedicated "co-located workspace" for the group photos. In addition to support photo management and sharing, the software aims to support sense of belonging and connectedness and social user experience [2, 21, 22] within the group by as the experience-based design ideology suggests [23].

The Social Camera prototype enables users to create shared photo albums and automatically distribute photographs within a selected group of people. The actual prototype application is divided into four logical sections: shared albums, own photos, notifications, and the camera. Shared albums are the core of the prototype application. The users are able to create and name new albums (Figure 1). The shared album content can be browsed similarly as the local device photo gallery. Users are able to browse by viewing thumbnails under different albums and touching a thumbnail to enlarge the photograph to a full screen size. Under the shared album name a list of users are displayed who share the same folder. Other people can be invited to join the shared albums using NFC i.e. selecting the invite option and bringing the devices in close proximity (Figure 1). The invitation to the shared album is sent automatically to the recipient for acceptance. Under the shared albums, the user is able to select the corresponding album to be default for the camera to assign new photographs to. The assignment can also be changed from the camera section while taking photographs. The captured photographs are distributed automatically to the members of the shared album.

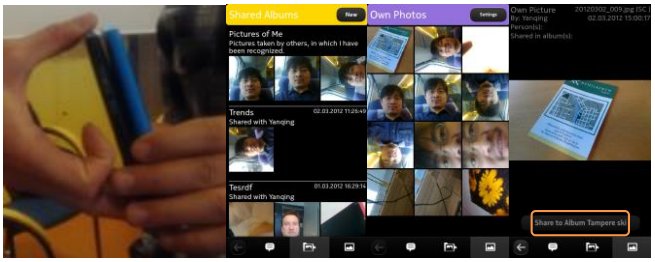

Figure 1. a) Inviting people to shared albums, b) Shared albums, c) Own photos and d) sharing to albums views in the Social Camera prototype

Alternatively the user is able to access her own photos view from the prototype and share photographs to the shared albums (Figure 1). The own photos view shows a grid view of available photographs in the device as the original photo gallery of the device. The notifications center shows a feed of recent activity to the users, including notifications on new photos in shared albums, new pictures of the user, and group invitations. The aim of the organized field study was to identify the needs for sharing

photos instantly within small groups, and to understand the social user experience in such activity. In order to collect actual use experiences of the application, a field trial was organized for four participating small groups. The participant groups included both non-technical photographers who do not use professional equipment and more advanced photographers with semi-pro or pro equipment. The groups were recruited through multiple mailing lists for students of Tampere universities and also through forums of photographers. Fig. 2 shows the events in which the groups participated in.

Figure 2. Photo taking and sharing activity of the groups during the trial

Background data of the participants was collected by using a web form before the interviews. The participant selection was made on basis of their equipment usage, age and activity of photographing and sharing habits in social networking services. The aim was to have four groups with different backgrounds. Group 1: Skiing family (2 fathers, 3 boys, ages 13-48) took the cameras to the skiing trip to Ylläs in Lapland, where they spend the holiday week, taking and sharing photographs with Social Camera. Group 2: Electronic music event group (1 female, 3 males, ages 18-35) went together to electronic music event, which lasted for twodays in Lahti. The group attended on various smaller events during the trial. Group 3: DJ club (2 female, 2 male, ages 24-27) had a ten days of trial period, where they attended a album release party, a student party cruise and smaller events events together and separately. Group 4: Group of friends (3 female, 1 male, ages 24-25) used the application in a evening get-together, a housewarming party and mostly individually during the week.

The data collection consisted of four different methods: the trial period of 1-2 weeks with the diaries, an individual interview of the trial experiences, a group interview concerning the small group sharing and future feature ideation and a user experience questionnaire with 19 statements. Each group trial started with the session where the test devices were handed out to the participants. In the session, participants were also introduced with the service in detail. Participants were given N9 smartphones with the Social Camera application software installed in the starting sessions, before the trial period. In the starting sessions a brief introduction for the application use was given. Participants were instructed to take photos with the given device throughout the trial period. Findings from the group interviews and diaries were treated as relative notes in the analysis. Comments in the interviews and diaries were transcribed and organized under themes.

5 Results

Creating and managing the collective group folders together was the peak experience of the trial for the most users. Users appreciated seeing the different viewpoints, getting pictures of themself from other photographers, and getting an idea of how others experienced the event. Users saw value in sharing instantly with close individuals and then expanding the audience if desired. There were major differences in the amount of photographing and sharing rates of the photos between the groups during the trial periods. The amount of all pictures captured ranged from 133 pictures in Group 1 to 742 pictures in Group 2. The different natures of the events the groups participated in explain some of the differences. Table 1 shows the photo taking and folder creation activity throughout the trial. For example, on the skiing trip, the wintery weather and poor network connections prevented photo sharing. Sharing rate also varied between the groups, as Table 1 shows.

	Group 1	**Group 2**	**Group 3**	**Group 4**
Users	5	4	4	4
Photos captured during the trial	133	742	158	264
Photos captured on average by person	26,6	185,5	39,5	66
Folders created	5	7	6	6
Subgroups created	0	1	2	3
Pictures shared	94	298	82	155
Sharing rate of pictures	0,71	0,4	0,52	0,59

Table 1. Photo taking and sharing activity of the groups during the trial

Group 2 had the lowest sharing rate, which also was referred to in the interviews, in which the group participants said that they selected the best photos only to be shared. Group 4 was active in creating subgroups and folders that were only shared to some of the users in the group. After the analysis of the diary and interview data, findings were categorized under the following main enablers: 1) connectedness and social awareness; 2) presentation and expression of self: sharing everyday life activities; 3) lightweight communication and surprises; 4) collective photography; 5) documentation of exceptional events; and 6) privacy, user control, and utility. Finding categories include the most promising use cases and motives for small-group sharing in the six categories. The finding categories can be divided into two types of photo experiences: long-term and short-term. The first three categories are short-term enablers, which are related to an instant and spontaneous photo sharing, and the latter three categories are related to long-term experiences and photo storage and archiving.

5.1. Instant Interactions and Social Presence to Support the Sense of Connectedness

The shared folder was a communication channel for the groups during the trial. Even in the cases where group members attended events separately, others were able to

follow their photos appearing in the group folder if they decided to carry the device and shoot photos. Since commenting, giving ratings or likes, and similar interaction features were left out of the implementation, people were forming ways to communicate with the photos only The peak experience was seeing the latest photos from others appearing in the system in real time when people were in different locations, it was fun to see what others were doing at the same time. The application created a channel for instant communication throughout the trial, and evidently enriched the social interaction of the participating groups. *"This gave me an excuse to see my friends!" Female, Group 4.* Photos appearing in the application in a real time motivated picture taking and sharing. *"I waited for T. to share his photos from a 'famous people cruise' but unfortunately he didn't have the connection and did not share them instantly onboard!" Female, Group 3.*

Group 3 had an album release event, which they attended together. Before the event, they were getting ready for the event and shared photos each on their own. Two males from the group were having dinner together and watched the photos sent by the female participant from her home, where she was doing programming homework. Afterwards at the album release events the whole group was photographing and speaking about the photos from before the event when they were preparing from the event. *"It was interesting to see the timeline from the members of our group, all on their way to the album release party in the evening. Me and M. were at the wings restaurant and the girls and others on their own route." Male, Group 4.*

The final wrap-up of the event happened at home, where participants watched the collection of photos form the evening. In the user experience questionnaire participants gave an average of 5.77 of 1-7 Likert scale in ratings, in which the standard deviation (SD.) was 1.71, to the statement "It was fun to share the photos with my friends in the service; whereas, "The service offered me a novel way to share photos got an average of 5.16 (SD. 1.87), and "This way to share photos was suitable for me," slightly lower with 4.88 (SD. 1.80).

In order to support a sense of connectedness with the application, the application should offer fresh and real-time content easily and should facilitate visibility for the newest updates. During the trial, participants followed the application, but in the longer term use of the application should give notifications to the user without the user having to actively to seek the newest content.

5.2. Expression and Presentation of Self - Sharing Everyday Life Activities

Participants reported that they saw motivation in sharing their everyday life in the system to the small audience. The application was seen as a channel to distribute random camera snapshots to others. Users shared pictures of details and surroundings or even scenes from the movies they were watching. It was stated that some of these snapshot only have meaning as a creators of social interaction and discussion and in that sense most of the participants also missed lightweight commenting features to the application. Self-expression and presentation of self through the application consisted of sharing new or current information about oneself to the group. Participants shared photos when they shot photos of their face gestures, telling others about their mood. One of the female participants in the group 3 said that all of the members of their group did not know about her musical hobby, so she wanted to tell about it. *"I wanted*

to send the others photos of my cembalo lessons in Riihimäki. All in our group wasn't aware that I even have such a hobby" Female, Group 3. Picture blogging or creating a photo diary of everyday activities was also seen as interesting option to utilize the application. Some of the participants shared snapshots of what they are at home. *"I see value if this would be a shared photo diary for our group, so everybody could easily share" Male, Group 4.*

In order to support self-expression the applications should offer clear control of privacy and effortless sharing to the targeted audience. Dedicated folder to one's own pictures in which others can react by adding their responses with photos but still realizing the actual author of the folder offers support for self-expression.

5.3. Photo-Based Communication to Support and Enrich Light-weight and Surprising Interaction

Light-weight communication with pictures was evidently strong in the trial (Figure 3). Participants used the application, for example, negotiating places and for inviting others to certain places.

Figure 3. Example of photo communications in the Group 3

Figure 3 shows examples of the photo communication the participants made in the DJ group. Participants used the application, for example, negotiating places and for inviting others to certain places. Since the classical means to communicate through comments, for example, was removed, users made up creative ways to interact through sending the photos. In some of the cases during the trial, users wanted to *tease* others by showing what they are up to. *"I was waiting for M. and O. to come to the Sunday chill music club. I shared few photos from there to hurry them up!" Male, Group 2.* In the questionnaire users gave averagely 4,06 (SD. 1,65) to the statement "The service offered positively surprising experiences".

A folder that is dedicated for the light interactions and spontaneous photos in addition to event-related, person-related or theme-related folders can support lightweight interactions within the group. Positively surprising experiences can be supported by features that offer targeted photos to the users automatically.

5.4. Shared Cloud Folder to Support Collective Photography

A collective cloud folder was seen as a suitable solution especially for close–knit small groups. The first group in the trial had, however, problems in comprehending

fully the shared folder concept. The group had a conceptual model from Facebook: every folder has an author. However, the idea of having many cameras taking trip photos and sending them to the same folder was really appreciated. Currently, they had to wait until each author uploads the photos on Facebook, which they mostly used, or through other means. The users appreciated the experience of seeing photos from all the members of the group put together. Only one of the four participating groups did not see extra value in sharing the photos within their particular group with the presented application. The user experience statement "the service helped me to share the photos within the group" gained an average of 5,98 (SD. 1,79) on the 1-7 Likert scale. "I liked the idea to create shared folders where to upload the photos for the whole group", gained a similar average of 5,98 (SD.1,82). On the concept level, the participants were satisfied with the photo-sharing application.

The group identity was built around the collectively shared folder during the trials. The collective folder in the cloud offered a shared workspace for sharing and storing experiences.

5.5. Sharing Exceptional Events – Support for Documentation

The participants agreed that the application is most suitable in situations in which the group would spend a certain period of time together but still be apart at times. For example, trips abroad, seminars or music events were said to be ideal for using the application. Participants saw the system most suitable for event photos that have a relatively short life span. Physical location of the people and how the group is scattered around define the way to interact through photos. During the trial the social and physical context of the group varied, and five different group location formations were faced: 1) Whole group at the same event physically together, 2) people scattered around at a bigger event, physically nearby, 3) one at home, seeing photos from others in the event, most of the group at the event, 4) one attending and sharing with others and 5) everyone in different locations. Browsing the photos was not as interesting when they all were at the same event, however, seeing the collection of photos from the whole group instantly after the events was an appreciated experience. *"It was nice to see the products of the whole group right after the event! It was nice to see the things that interest others. I would like to share video also though." Male, Group 2.* The electronic music group was documenting the music event at Lahti together, whereas the boys from the Group 1 were shooting photos of their tricks while skiing at Ylläs and instantly sharing them. Storytelling for those who were not present by using the application was seen as an interesting idea. *"If we had this when we were together with the club in Berlin and tried to get in to different clubs. There were 18 of us and only a few got in so they could share the experience and tease others when they get in." Male, Group 3.*

Users had to implicitly select the photos for sharing after the capture. Most of them would like to have an easy sharing mode, where all the captured photos could be automatically transferred to the event folder in special occasions. Event-based folders must be created instantly on the spot of the event or, alternatively, before the event. The access should be granted to the attendees or content contributors. Also features for expanding the group with the acceptance of the group should be included.

5.6. Support for Privacy and User control

Ahern et al.[25] have identified four factors that affect people's privacy while sharing digital photos: security, identity, social disclosure, convenience. Most of the concerns in the trial were related to questions such as: who can access the content? What if the group is extended by others I do not know? The application included feature of inviting others to the shared folder by holding two devices against each other, which means that every owner of the group folder could invite new users to the group folder. Despite the novelty of the inviting feature, users had concerns that the folder could expand accidentally and on the other hand the feature was said to actually prevent people from spontaneous sharing: creating new event folder and sharing spontaneously is not supported since people need to be physically close to start sharing. Users wanted to remove pictures that they did not like or wanted to give a suggestion for removal if the photo is taken by other user. Also those who are able to view the shared folder need to be visible in the application, so everyone knows how publicly the photos are shared.

Privacy-related statements got relatively low ratings in the user experience questionnaire. " I felt that I'm in control of the privacy of my photos in the service" got surprisingly low average of 1,94 (SD. 1,08), where "I felt my photos are safe in the service" got relatively higher average of 3,03 (SD. 1,51). "I could recommend the service to my friends" gained 4,24 (SD. 1,46). Answers show that users had concerns on the privacy aspects of the technology. Positive comments of the application privacy also occurred, and they mainly related to the possibility to limit the group to share with. Comments from the interview also indicate strong ownership feel of "my folder". *"I want to share my photos to the close friends group that I've selected myself, not everyone in Facebook. That's why I like the privacy thinking." Female, Group 4. "I did not like that he posted pictures into my album, I only wanted to give others the viewing rights." Female, Group 3*

Based on the findings in the study privacy of one's photos and especially feel of control is a hygiene factor for positive user experience. Distrust towards the application can prevent users from handing their photos out to the application.

7 Discussion and Conclusion

The results of the field study with Social Camera reveal the following main enablers of photo-sharing experience in small groups: 1) instant interactions and social presence to support a sense of connectedness, 2) expression and presentation of self by sharing everyday-life activities, 3) photo-based communication to support and nrich lightweight and surprising interaction, 4) shared cloud folder to support collective photography, 5) sharing exceptional events for experience documentation, and 6) privacy and user control. The found enablers are in line with the findings in the related work but extend knowledge of the factors of the social user experience. However, their validity should be evaluated in follow-up studies in different group contexts and with different content types. In summary, the study implies the value of the collective online folder on the photo experience for small groups. Implementation

of Social Camera lacked aforementioned features such as online sharing with remote people who are not in the formed group, forming groups remotely, commenting and picture descriptions, integration of the application in the native camera, and notifications. Still, users saw value in sharing photos instantly using a lightweight approach.

The evaluated implementation of the application introduced on purpose controversial features for testing the boundaries that users perceive with regard to privacy and the surprise factors. Putting ones' photos or any personal content visible for others online seems to include a motivational aspect of collecting others' comments and also to follow the interaction, discussion, and history around the photos. Users wanted to know which photos got attention from others. Most said that they would like to see others' actions in the folders but maybe not share all of their browsing information. After the study, Social Camera was expanded with a channel for communication through emotional responses [26].

The field trial examined a selection of different events that groups attended. The different group formations at the events gave an idea of the real use of the system, where only a part of the interest group attends the event. The photos are interesting afterwards to these who have attended the event and also in real-time to those who are following the event remotely. Limitations of the implementation and problems with Internet connection prevented peak experiences occurring within some of the groups, but the idea of instant small-group sharing was received positively. The results of this field trial give support to the development of instant photo-sharing solutions for small groups. A promising approach to the group formation theme in the future could be to concentrate more on events and spontaneously created groups.

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Technique for Evaluating Photo Sharing Interfaces with the Early Prototypes - Group Simulation

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Abstract. User evaluations using paper prototypes commonly lack social context. The *Group simulation technique* described in this paper offers a solution to this problem. The study introduces an early-phase participatory design technique targeted for small groups. The proposed technique is used for evaluating an interface, which enables group work in photo collection creation. Three groups of four users, 12 in total, took part in a simulation session where they tested a low-fidelity design concept that included their own personal photo content from an event that their group attended together. The users' own content was used to evoke natural experiences. Our results indicate that the technique helped users to naturally engage with the prototype in the session. The technique is suggested to be suitable for evaluating other early-phase concepts and to guide design solutions, especially with the concepts that include users' personal content and enable content sharing.

Keywords: User studies, participatory design, mobile interfaces, personal content management, content sharing, social interaction, user experience, design.

1 Introduction

The number of social networking services (SNS) [1], content management and sharing services hand in hand with the devices for capturing and storing content has exploded in recent years. Digital content sharing has grown rapidly hand in hand with the development of capturing devices, social networking and file sharing services. Social media and social networking services are growingly relying on personal content that is shared or published in these services. Since capturing images and editing them has become easier and applications available and usable to everyone, the new focus is designing experience of photo enjoyment [2]. While producing the photos has become easier, practices for enjoying the digital photos together as when people gathered to watch the freshly developed set of printed photos some years ago has changed [3]. Users capture personal content with multiple devices such as mobile phones, digital cameras and video

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capturing devices. Organizing and managing the massive collections on hard disks and online has become a burden for the users.

Users are not only dealing with the photos taken by themselves, but also those taken by others. Managing and maintaining the growing personal inventories [4, 5] of photos and other personal media [6, 7] and sharing the meaningful content with others [8, 9, 10, 11] has become an interesting area for research and development. Novel solutions and design methods for creating pleasurable user experiences are needed.

The first objective of the simulations in this research was to create real interaction within the group using their own personal content. As previous studies show, collectively created and shared content can develop into highly emotional objects and work as a central motivator for the interaction in a group [12, 13]. The research contribution of this work is two-folded. Firstly, it evaluates the concept and, secondly, it contributes to the field of participatory design with a group simulation technique that involving users' actual personally created content.

Goals of this study are:

- To evaluate the technique of using participants' own content in early phase prototype simulation.
- To identify habits of collaboration in the photo organization and sharing by observing users' interactions with the prototype in the simulation sessions.
- To evaluate the concept by using the early prototype in the simulation sessions
- To contribute to design recommendations and implications for photo-sharing systems we aim to identify the weak signals that users give in their group working and learn how social context can actualized in the prototype.

This work contributes to Human-Computer interaction research field firstly, by introducing a concept for small group photo sharing and, secondly, by introducing a technique for designing and evaluating similar content sharing applications in an early phase of development.

2 Related Work

New photographing devices support users in taking the photos, but all the effort that is made after photographing offers more interesting areas for development. Kirk et al. [14] have identified and named the process that happens after the photo capturing as "*photowork"* and the authors have identified and categorized the activities that people perform on their digital photos. In the study [14] photowork was categorized in to actions of finding, sharing and receiving. Similarly, Lehikoinen and others [15] introduce "get, enjoy, maintain and share" –model for the personal content, which describes the process of the content experiencing. The work identifies patterns that occur before sharing and publishing PC use of digital photographs and paper prints have been extensively studied in the past [16]. Frohlich et al. introduce four categories of photo-sharing activities: co-present and remote sharing, archiving and sending.

Current solutions of *photoware* [16] should enable all of these activities within a single system and remove the boundaries between these practices.

In a study by Miller and Edwards [17], users described a habit of downloading pictures of others as a part of their own photo collection. Most of the users added photos of others to their collection in the study and did not see any particular problems in that. The study describes two cultures of photo sharing "snaprs" and "Kodak-culture". The Snaprs had shifted their photowork and sharing almost entirely to SNS, where Kodak-culture shared digital photos through mail very limitedly [17]. Due to the different channels these groups had different socialization styles related to photos.

2.1 Designing Photo Sharing Technology for Small Groups

Previous studies of photo sharing and photowork have identified problems in archiving the photos. Some of these problems are still not answered with technology. Photos are identified in many studies as highly personal content. For this reason, people are very sensitive with sharing photos and videos of their close-ones and the groups they belong to. The people are more eager to share personal content within the private circles such as family and close friends, as previous studies show [18]. Sharing photos to small groups, such as relatives, close friends or private groups has different motivations and needs than sharing to bigger audiences. Olsson [10] introduces three-fold motivations for photo collecting and sharing. The main motivator for storing personal photos and making private collection is claimed to be personal growth and identity building. Sharing to small groups mostly includes documenting everyday life, sharing memories and telling stories of meaningful events or extraordinary occasions

In the study by Petrelli and Whittaker [19] meaningful objects for family memories were studied and results show that 16% of the meaningful objects that participants chose from their homes were physical photos. Functions of the memorial objects that were identified in the study were: important event, relationship, activities, personal reminiscence, identity and personal achievements.

When people share photos with relatives and friends, the main motivator is be strengthening the existing social ties [28]. The most public level of sharing, where photos are put out to whole community or service, includes motivational factors of self-expression and getting attention from others [19, 20 21]. Self-expressional needs and presenting oneself through the photographs come up in both sharing photos regardless of the size of the target audience [20, 21]. Adjustments of privacy levels become an issue, when photos are shared through online systems. For some users personal photos are the most sensitive objects of their personal content. Frohlich and others [16] introduce taxonomy of sharing usage, where time and presence are the most important factors. Sharing of photos includes personal archiving as a starting point ("sharing to self"), sending and remote sharing with others online and co-present sharing that can include co-present sharing with online-services or other devices.

Cloud computing technology allows new solutions for archiving the photos outside the hard disks and drives. Databases and storages that are accessible everywhere and through different devices have been introduced [22]. MyLifeBits is a personal collection, which aims for managing all the other digital content. Other services and

concepts such as Dropbox [23] for all the digital content and Picasa for photos only have been introduced lately for full content management and sharing. Idea of these collections is to create a personal inventory that is accessible anywhere and with many devices. The fragmentation of the personal content also means that content is accessible from many locations and devices, also across the platforms [24].

Co-present or collocated [25, 26] sharing of photos with mobile phones has been studied widely earlier. These studies introduce new concepts that support novel interaction models with many mobile devices. Sharing can happen collaboratively by synchronous and shared screens. "pass-them-around" prototype introduces way of using multiple mobile phones to view the photo collection of the group [18].

New technologies to share and present photos for selected and limited group have been developed recently. Most of these technologies use mobile phones as photographing device but as a device for group formation and photo presentation and viewing. Feed me–system supports "directed sharing" [7] that recognizes users close contacts and their interests and aims to more effective and targeted sharing of content. Nunes et al. [27] introduced "Souvenirs" prototype that enables users to link photos with physical memorabilia in the home environment. In the study, it was seen that photo collections only on the hard disk of the computer can prevent users from spontaneous presenting and experiencing the photos together. Digitalization of the photo collections [28] can evoke feeling of inability to access digital photos freely, which can be a source of frustration, as a study by Petrelli and Whittaker [19] suggests.

Battarbee suggests that designing for co-experience should always include the social context and that "more than one person is involved in a unit of study, to create the conditions for co-experience in a manner that is appropriate for the design context." [29]. Battarbee suggests that designers should take part as the co-experiencers. Group simulation aims to support participation of users in a design process in a novel and light-weight way.

2.2 Participatory Design in an Early Phase Development

Social features in interfaces introduce a new area for early evaluation of the services and devices. Systems and software that enable social interaction and are targeted for sharing personal content can only be fully understood by using the users' actual content instead of generated content that is normally used in paper prototypes or even in more functional prototypes.

The problem with classical paper prototypes is the generic nature of the content, which mostly is added or created by the researchers, designers or developers. The interaction with content created by the researchers can vary from the interaction with personal content. Same problem may occur in the implemented interactive prototypes, as the critical mass of users to produce the content is hard to reach. In the systems, applications and services that enable management and sharing personal content the privacy aspects as well as the motivations to use the solutions are revealed only when the actual content is available. By investing time and resources to collect actual personal content that is created by the users themselves, the work aims to make the prototype more personal and thereby more meaningful to users. User interviews and

focus groups are suitable methods for collecting feedback for developing new concepts and collecting ideas from current needs and practices, but early evaluation of concepts needs other kinds of study designs.

The use of early stage prototypes in a participatory design has been studied before. Hagen and others [30] describe characteristics of a *simulation* study in mobile research. Simulations aim to "reflect or recreate a mobile use situation" [30]. However, traditional simulations are criticized of not including the social context or "social environment" [31] to the early-stage evaluations. The *Group simulation* described in this paper aims to solve this problem by adding the social context of a group and users' personally created content to the prototype. Prototype is evaluated by participatory design sessions by using the technique of simulation [30].

Participatory design workshops have used mock-ups and physical, but non-functional prototypes to create hands-on experiences [32] as well as imaginary "make tools" [33] to give users free hands to imagine the features they need but are not yet present. Using tangible and physical mock-ups and real objects that may have "magical" or imagined features is a powerful way to generate ideas. Through the use of make tools users are able to express the needs they have for new technology that may not yet exist. Another participatory design direction is "bodystorming" [34] in a sense to arrange workshops in real contexts. This paper uses these ideas to generate real social context and facilitate the interaction in the session through tangible prototype that is a real world "photo book" object with added functionality that is facilitated by the researchers acting as the service intelligence in the sessions. "Wizard of Oz"-technique in participatory design as well as in usability testing is a technique where user interacts with a prototype that is actually manipulated by a researcher [32, 35]. In these settings, users are sometimes aware of the setting, but sometimes left uninformed that actually the device intelligence is not artificial.

3 Prototype Design

The idea of a system that enables instant photo sharing and uploading was crafted in the project. Earlier studies have shown that users had a need for instant sharing of photos especially within their close contacts [15, 27, 5, 10]. In order to evaluate the created concept idea and to validate the actual features to be implemented the concept was introduced to the participants with a paper prototype in the group simulation sessions. As a paper prototype, we used dedicated *photo books*. The construction and content collection of these photo books are described later in the methods part. All of the functions in the system were introduced to the participants by using "Wizard of Oz"-technique. The researchers worked as the "intelligence" of the system in the simulations sessions. They performed as facilitators of the social interaction functionality and the features in the system, so the users could get idea of the complete functionality prototype offers. The private group setting and instant sharing are the key differentiators from conventional photo sharing tools such as Facebook [36] or Flickr [37]. In our current setup, user's photos are directly uploaded to a shared album, which is accessible to relevant users [38].

The prototype implementation included special features that were introduced to the users in the sessions. In the start of the session, users were introduced with two novel ways to interact with the system: *FingerPrints* and *MoodPhotos*. Additionally the prototype also included *My Picture Everywhere* function.

MoodPhotos gathers users' facial expression during the use of system. When user browses through photos in the album, system captures certain expressions by front camera of the mobile for example. These expression photos can then be shared to other watchers browsing the same photo. User can add her mood photos from a sequence of photos that the device has automatically taken while you were viewing the image. User can either select from the captured mood photos or pose and take a new one to share. The concept uses front camera of mobile phones or laptops to detect the face of the viewer. When a user browses a photo from a shared album for a prolonged time, a counter indicates mood photos and fingerprints that other people have left on the image. Mood Photos feature aims for target experience of instantly sharing emotional reactions to photos [38] and thus give users feel of relatedness through the technology [2].

The FingerPrint concept uses the metaphor of physical photo sharing where viewers unintentionally leave their fingerprints on photos. Idea is to use the metaphor in more positive sense in order to disclose other users the activities of watchers of the photo. Users are able to view consumption patterns of their photos. The fingerprints are shown in different colours, sizes and intensity to represent type of friends (e.g. colleague, family), frequency, recent activity and the length of viewing [38].

My Picture Everywhere concept gives users information of the photos in which they appear. My Picture Everywhere uses face recognition algorithms to detect the photos that user appears in and provides then option to contact the author of the photo.

4 Research Method

Simulation sessions were held with each group. In the session participants were introduced with a concept that enables instant photo sharing within their small group.

Each session with groups started with an introductory session, where users were given instructions for their co-creation event in which they took part together. After the event they were invited to the simulation sessions. Sessions included introduction to the concept prototype service and feature concepts, individual browsing sessions and in the end group interview.

During the introductory session each user was guided to take at least 20 photographs in an event that they arranged. This event was planned in a way it would be optimal for being a *co-creation event* where users would spend time together and take as many photos of the event, each other and the whole group.

After their co-creation event together users shared the photos with the researchers. They were ordered not to show the photos to each other before the simulation sessions, so they would see the photos taken by others first time in the event. Simulation

sessions were organized 1-2 weeks after their *content co-creation event.* Researchers analyzed the photos and created dedicated *photo books* for the simulation sessions from the event photos.

4.1 Background of the Participating Groups

Participant groups were recruited from the mailing lists, social media services, forums and researchers' contacts. Study included three groups of potential users of the studied system. Each group consisted of four members. The participant groups were recruited through multiple mailing lists for students of Tampere Universities and through forums of photographers.

Background data of the participants was collected by using a web form before the interviews. The participants were screened for the study by their answers in the web form. The selection was made on basis of their equipment usage, age and activity of photographing and sharing habits in social networking services. The aim was to have four groups with different backgrounds. The participant groups include both non-technical photographers who do not use professional equipment and more advanced photographers with semi-pro or pro equipment.

All the participant groups had organized an event together, where they captured the photos for the simulation (Fig. 1).

Fig. 1. Users photos from their events. Photo on the left is from Group 1 and their bowling event, photo on the center shows Group 2 in a music concert, photo on the right shows Group 3 and their social event at one of the members' home.

The participant groups were informed to select events where they would normally take photos. Selections of photos to describe the nature of the main events the groups participated in is given in Fig. 1. Bowling group consisted of students (2 males, 2 females, ages 27-30). The group went bowling and had a dinner together. Music festival group consisted of students (3 males, 1 female, ages 22-26) and they took part in "Lost in Music 2011" indoor festival in Tampere. Senior photographers consisted of four pensioners (all females, ages 67-72). They arranged a party together at one of the group members' home in Tampere. Participants were instructed to take at least 20 photos in their co-creation sessions. The activity of participants was surprising, and they took totally 782 photos for the photo books in their events (Table 1).

Table 1. Number of photos captured in the co-creation events

Participant	Number of photos added by participant	Group (total number of photos)
U1	112	Bowling (273)
U2	23	Bowling (273)
U3	66	Bowling (273)
U4	22	Bowling (273)
U5	160	Music (378)
U6	48	Music (378)
U7	56	Music (378)
U8	114	Music (378)
U9	35	Camera club (181)
U10	47	Camera club (181)
U11	55	Camera club (181)
U12	44	Camera club (181)
Total	**782**	**All groups (782)**

Music group was the most active in the photo taking, and partial reason may be the event that they attended. All the groups kept their photos in privacy and did not show them to others before the simulations, so the simulations could really represent the first browsing session of the folders (Table 1).

4.2 Simulating the Prototype Functionality with the Photo Books as Prototype

For demonstrating the functionality and the features in a tangible and physical approach, the *photo books* were created (Figure 1). For every session three different photo books were created from the photos that users had captured. Each photo book consisted of 15-20 photos totally. The photos selected from collection that they had created during the co-creation events. The photos were added to the book in a random sequence. The photos were added on the background graphic layer of photo book prototype service. A transparency that showed the graphic user interface and the features was added in top of each picture.

Paper prototypes were selected for the study instead of using actual interactive implementations at the early phase in order to test the validity and suitability of the concept as early in the development process as possible. Using the real life objects such as photo books can reveal ways of interaction that may not occur with the implementations. This study aims to exploit physical world and real interactions in order to duplicate similar interaction in the actual implementation later on.

Photo books (Fig. 2) were used as a paper prototype of the photo sharing service where people are able to easily share their photos within the small group. Photo books included Moods and FingerPrints functionality as represented earlier.

Fig. 2. Photo book was created of the photos users had taken together in their co-creation events. Functionalities are added on a transparency layer on the top of the pages.

Users were given brief description of the photo book at the start of the simulation. It represents a shared group folder on the cloud where all the group photos they have taken in the event have automatically appeared. In the simulation sessions they were able to see the photos taken by others for the first time. As the Fig. 2 describes, functionalities in the service were shown to the users in transparencies that were added on top of the photo book pages. So users were able to browse folders with the functional layer, or remove it and watch only the photos by turning the transparency pages.

Mood Photos functionality was demonstrated to the users by using web cameras and printers in order to give users option to add pictures of their reactions to other users' photos. They were able to add them by their own will.

Photo book functionality was intentionally explained in a rather low detail and instead users were instructed to interact and add comments in the way they felt natural and their actions were observed and recorded. These observations were analyzed in order to identify natural interaction habits for design ideas to the concept.

4.3 Setup of the Simulation Sessions

Simulation sessions were organized in a way that participants had time to get to know to the interviewing group and the surroundings. This created relaxed and open atmosphere to the session, which helped participants to express their ideas and set them to right mood of creativity.

In order to simulate usage sessions of the photo sharing service four users were divided into three stations. Each member was observed individually at 4 sessions where they browsed the photo books. Each session lasted for 30 minutes.

The 3 user Stations were organized in the session as follows: the Station A with two users, B and C with single user. In the station A the system use was simulated together with two participants. Researchers started from the decided stations, circulated all the stations carrying the same photo book all the time. During the individual sessions users added comments and thus communicated with each other through the photo book (Fig. 3).

Fig. 3. On the left, individual photo browsing session in the group simulations on the station B. On the right, station A with two participants browsing and commenting the content in a joint session. Web camera is monitoring the interaction on the left.

The photo books circulated through each station collecting the comments and content from each participant (Fig. 3). After the photo books had circulated each station, a summative group interview was held. Each researcher completed thus totally four sessions with users, including the ending session where they returned to the station where they started from. At the end of the circulation session the participants were shown photo book they started working with, with additions made by others (Figure 4 and 5). This technique allowed researcher to become familiar with all the users and to gain deep knowledge of their own photo book and its contents. As mentioned before, simulations used modified technique of "Wizard of Oz" [32]. Researchers worked as the intelligence and functionality of the service in the simulation supporting and facilitating the interaction. Users were aware of the role of the researchers all the time.

Fig. 4. Social interaction cues added to the transparency layer of the photobooks. Picture on the left, during the session. Picture on the right, after the session with all the interaction cues added.

The circulation was arranged to represent photo application browsing sessions of the shared folder of photos in the system. In the individual session the users created collaborative collection together. Their collaboratively created album was represented in the group interview at the end of the session (Fig. 4). The pictures that appeared in the final collection were the ones that collected comments, or the ones users spent the most time with in the browsing sessions. This represents the detection of most meaningful pictures in the concept. The collaboratively commented album was in the end of the sessions represented in the group interview (Fig. 5).

Fig. 5. Group interview session. The users are gathered around the table full of photos they have commented and browsed in the simulation.

The pictures that appeared in the final collection, which was presented in the group interview session, were the ones that evoked emotions, comments or which users spent most time with in the browsing sessions. This phase of the session represents the automatic detection of most meaningful pictures that have gained the most interest in the concept (Fig. 5). In the end of the simulation sessions, users were gathered together around the table where the most commented photos were scattered (Fig. 4) and the actual group interview was completed in the vicinity of the groups' photo content. Users were able to see the collection they had created together in the events, by additional content and comments from the simulation sessions (Fig. 4) to fully understand the interaction possible through the concept.

5 Results

Users were given three detailed concepts in the simulation sessions for interacting with other people in the simulation sessions by using the prototype. Two of these features are designed for social interaction and one to notify the user when her photos appear in the service. Usage of these concepts was observed. From the observations, conclusions were made on the interaction between the members of a group through their shared album.

All of the concepts were seen suitable for working with personal, emotional photos that are shared within a close group. There were differences especially regarding to the openness of sharing and commenting. Some of these concerns are related to the age and experience of SNS use. However, habits of commenting and collaborating repeated regardless of the age and experience. All of the participants commented and created collaborative content to the book in a rather similar fashion.

The idea of collecting all the photos from every photographer into a same album was highly appreciated. The users appreciated seeing the different viewpoints and styles of photographing, to get pictures of themselves in the events and to get an idea of how others experienced the event.

5.1 Design Implications and Considerations Related to Small-Group Sharing

Creating a shared photo book together was stated to be a peak experience. Even using Dropbox for photo sharing was a new and pleasant experience for many. The concept of shared or collaboratively created and maintained folder was also much appreciated. The concept was described by the participants as shared folder or a pool of photos by many authors that the members could join and contribute to.

The first round of the analysis of the results concentrated on the groups as study cases [39]. The group session records were observed and analysed individually utilizing a qualitative and descriptive approach. This phase was completed by three researchers individually. In the second round, the analysis followed "grounded theory" methodology [40]. In this analysis phase, all the groups where studied and analyzed together, using the affinity diagram method. In this phase, all the researchers

collaborated in the analysis. Findings from the second round of analysis were organized under the themes and statements that are presented in the following.

Users appreciate simplicity in the system design; they want to be able to concentrate on the content. If there are too many different features in the system the overview may become messy. Nonetheless, commenting and leaving marks for other users was much appreciated and evoke emotions, all users demonstrated the willingness to concentrate on the content of the photos only. They wanted features of removing all of the additional data, so that the photo could rise to the top, and they could really enjoy watching the photos.

To have a sense of control over the content is important even in small group setting. Users wanted to remove pictures that they did not like or wanted to give a suggestion for removal to the author. Viewers of the shared folder need to be visible, so everyone knows how publicly the photos are shared. Authorship, in a sense, poses a difficult question, since users want to be able to remove the photos where they are presented. On the other hand, others removing the photos from the author can lower the sense of control over one's own content.

Recognition and feedback from others adds value to pictures. Users expected others to react and comment on their pictures if they are shared between the closed group. However, if the photos are automatically transferred to a shared folder, users need automatic notifications that others have seen them. One of the concepts had solution of informing the members of the visits of others.

Users want to know about actions of others: who have seen their photos. Others' consumption activities can work as social navigation cues. Photos became more meaningful for the participants when the circulations were done, and others had commented on them. Even the photos they did not see interesting at the start tend to become interesting when there was content from others. They wanted to see which photos gathered others attention.

Users appreciated neutral way to notify others that they have seen the photos. On the other hand, participants were interested in seeing the popularity and activity in their photos even in limited small group setting. Following popularity is identified as a motivator for content creation in other contexts as well [9, 10].

Identity of others and contextual cues are important. Users wanted to know who saw and commented their photos. Anonymous comments were frustrating. If persons who do not belong to the group see their photos, or appear in their photos, they want a clarification about how they relate to their group or networks of friends. Comments are only made on the most interesting or special pictures. Some wanted to browse through all the pictures before giving comments or other messages. Some gave comment or reaction right after seeing a photo that got their attention. The pictures that had collected attention and comment from others had a tendency to collect more comments from the viewer as well. The Mood photos worked reciprocally: users wanted to respond to others' reactions with their own.

Shared ownership of the photos divides opinions. Some of the photographers wanted to get credit of the photos they had taken and shared even inside the closed group. They were willing to add the photos to the shared pool for commenting, but they wanted to maintain the info who has taken the picture. Some were concerned

about the authorship and editing rights of the photos in shared pool: who can remove the photos and who can publish them outside the group, and is the permission needed from the object in the picture. *Group formation and sharing outside the group are essential.* Since one of the concepts introduced idea of getting notifications and photos outside the closed group, and for sharing the photos outside the group, users started to consider the privacy issues of this shared collection. Seeing the pictures where they appear was seen as a nice feature, but informing others of their photos that include people outside the group was more problematic.

5.2 Evaluation of the Group Simulation Technique

As the study shows, the group simulation technique with the paper prototypes and users' own content is an effective tool for evaluating the social concepts in an early phase. It is efficient in testing the basic design of the concept as well as to get an idea whether the target experiences are reached with the concept. In the simulation, users were able to understand the features that the concept will offer when it is fully implemented.

The technique of circulating the photo books to simulate the browsing sessions in the photo sharing service was seen as an effective approach to demonstrate the functionality of the concepts and observe users in the sessions. Leaving some functionalities and features of the concepts open for discussion and ideas worked for the most creative users, but some were confused and wanted more concrete ideas and instructions how the functionalities really work in the prototype.

Users personally created content, which was utilized in the prototype, was highly motivating for the user groups to work with. Especially in a concept that is related to actual personal content of users, the demonstration or prototype with content generated by the researchers or demo content will leave the experience superficial, and users may not understand the system in a way that they would actually use it with their own content included. This study shows users own content really motivates them to react and comment in the simulation. Users were actually interested in the content, because they saw the photos of others in the group for the first time in the session, which evoked emotional responses to a certain photos. The simulation added to the amount of commenting, and most said that they would not comment that much in real use of the services. Results and feedback concerning the actual features of the prototype are introduced in details in another publication [38].

6 Discussion

The technique was suitable for collecting information about the social use of the photographs in a small group. The paper prototype was effective in collecting information how participants would naturally comment and interact with the shared photos they have captured as a group. Giving users free hands in the commenting and creating content together gave valuable information on interaction methods to add to the collaborative implementation. The ideology of "make tools" [33] and using the real world

object such as photo book gave users freedom to be creative and take part in the design process. The technique is suggested to be a tool for design as well as collecting data of the content sharing habits and interactions within the group.

Researchers acting as the "intelligent features" of the system and facilitators of the interaction through the system offered a method of demonstrating and evaluating the sophisticated features in the early phase prototype. At certain points of the sessions participants had problems interacting in a natural manner when the researchers facilitated the interaction, but with only a couple of exceptions users accepted that researchers facilitate and simulate the interaction. Using several researchers in the session saves implementation time and allows the concepts to be tested in an early phase of the implementation – before actual software is completed. Using the group simulation session with more complete implementations or "demo features" could add one level to the simulation. Demo functionality presented by videos or partly functional prototypes could be compensated with the researchers circulating and delivering the messages and interaction.

The technique can be utilized in a design process of many kinds of applications that aim for content sharing. Other media content formats may require implementation of prototype software instead of paper prototypes. Nevertheless, investing time on the content collection can give more realistic evaluation results for the prototype.

In the future the group simulation method could be studied in a more controlled setting by comparing it to the test group using generated content in a similar simulation. Comparing the technique to classical paper prototypes should be completed to validate the efficiency of the technique.

7 Conclusions

This study contributes to the HCI and participatory design field by introducing technique for arranging simulation sessions with paper prototypes to small groups, involving the aspect of social context that previously has been missing from the prototype evaluation sessions. The research contribution of this work is two-folded. Firstly, it evaluates the concept and, secondly, it contributes to the field of participatory design with group simulation technique that uses users' actual personal content. As the study results describe, users saw simulation sessions with the content they had previously created together highly motivating and fun.

The technique is suitable for evaluating concepts that include personal content such as photos and enable sharing with small groups. It poses problems in finding the actual usability and design flaws that can be found in an actual usability test but it offers possibility to evaluate the concepts in an early stage of the process. In spite of the before mentioned problems, it was proven to be a effective tool for evaluating the designs in an early phase. It is suggested for the design cases, where implementing the interactive prototype will take time and populating the service with the users and the user-generated content even more time and effort. This study concentrated on the development of a photo sharing application, but by slight modifications the simulation technique can be applied to cover different kinds of solutions for group working as

well. From the findings of the sessions a functional prototype was implemented. Testing of the functional prototype with the group of users will continue the work presented in this paper.

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