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ORIGINAL ARTICLE

Contextual aspects of typical viewing situations: a new perspective for recommending television and video content

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Abstract In this paper, we present a better understanding of the contextual aspects that determine TV and video viewing situations in the home. The results can be used to design recommender systems algorithms and interfaces for TV and video content that better fits with different viewing situations in the home. This is achieved by taking into account these typical viewing situations and the respective manifestations of contextual factors. In a first, ethnographic, study with 12 households to better understand everyday viewing practices, we obtained insights into the relation between the type of content and the amount of attention paid, the type of content and planned versus spontaneous behaviour, the role of the structure of the household, and the way people discover content. In a second, multi-method, study with seven households, we identified seven typical viewing situations and elaborated on how four important contextual factors—time, mood, content and viewers—constitute these viewing situations or experiences in the home. After combining the results from both studies, two additional contextual aspects were added: content delivery type and viewing mode. The insights from these studies allow us to suggest opportunities for the design of recommender system algorithms that take into account the four contextual aspects and to formulate implications for the design of recommender interfaces.

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1 Introduction

In the broadcast era of television, the programming of the content was rigid. The television channels formed the main viewing options, and broadcast companies determined the programming. The viewer did not have much control or influence over the offered content, nor over the moments he or she could view this content. Currently, however, the position of the viewer has altered significantly due to two important recent evolutions. Firstly, viewers have more options to determine when they will watch certain content via time shifting on set-top boxes and digital video recorders (DVRs), illegal downloads, and legal video-on-demand (VoD) streaming services. Secondly, the amount of video and television content offered via various channels at this time is huge; viewers have a lot more options to look for certain content they want to watch. In short, this means that viewers now have much more influence and control over their own viewing consumption.

The newly acquired possibilities for the viewer—a greatly increased content offer and more ways to control their viewing activities—paradoxically make it more difficult to find the right content and to comprehend the different options for watching a certain programme. These difficulties have their ground in a number of characteristics of the new media landscape. Firstly, the amount of available content has become so large that it is almost impossible to oversee. Secondly, the current state of the television and video industry is very complex and consequently exposes viewers to different prices and pricing mechanisms, different content catalogues, different devices

for watching TV (video game consoles, media devices such as the Apple TV, smart TVs with apps, DVRs, laptops, personal computers and mobile devices), and different rights to the content involved (being able to watch a programme forever, for a month, for a week of just once). It is therefore important that we find ways to make it easier again for the viewer to find the right content and control they way he or she wants to watch it.

Recommender systems offer different ways to overcome one of these problems, namely finding suitable items in a very large collection of possible items [1, 2]. Via several mathematical modelling techniques, this research field tries to address the problem of finding suitable items for an individual, for a group, and for specific contexts. The methodologies used in this field are overwhelmingly quantitative in nature, which usually implies that such studies focus on one aspect (for example, group recommendations) or one specific algorithm in order to evaluate its effectiveness using a large data set. The disadvantage of using such approaches is that it becomes harder to investigate the holistic user experience, or to fully understand the context of the user [3]. In contrast, we use a phenomenological approach. Methods aligned with this view are usually qualitative and ethnographical in nature. As such, these methods offer rich accounts of how people interact with technology, and how several contextual elements influence the unfolding of this interaction.

Although the algorithms can help users find the right content to a great extent by offering suitable sets of content items, they do not provide a complete solution for a user. The actual interaction (experience) between the user and the system that offers the items also needs to be considered. Churchill refers to finding suitable items out of a large set by making use of what is known about the user as "outcome personalization" [4]. However, she points out that the quality of the interaction, referred to as "process personalization", is equally important and needs more study. Process personalization can be programmed and routine such as when one goes to "a chain restaurant—the same greeting, the same uniform, the same conversational exchange", or it can be customized: "Customized personalization is about personalizing to the consumer's interactional style and needs in the moment, as well as more stable or longer-term facets such as their demographic profile and/or manifest tastes" [4, p14]. It is in this regard that we want to gain a better understanding of how households consume video and TV content, what the typical viewing situations are, and what the users' needs are in each of these situations (or moments).

Our first study aimed to capture how different households watch TV in the current media landscape and provides an understanding of the contextual aspects of TV and video watching behaviour in the home. Because we wanted to obtain reliable data concerning actual viewing behaviour, we chose to conduct a three-week diary study followed by in-home interviews guided by the respective diary entries. Our second study focused on the contextual aspects that determine TV and video viewing in the home and on how the combinations of these contextual aspects constitute different viewing situations or experiences in the home. The relevant contextual aspects—time, mood, content, and viewers—are derived from the literature. The second study therefore allows us to understand how different households made sense of their viewing situations and experiences based on time, mood, content, and viewers.

Our contribution is twofold: our results incorporate more contextual aspects to determine different viewing situations compared to what is known in the literature and we employ a higher granularity in each of the manifestations of these contextual aspects. The results therefore allow us to design recommender systems that better fit household viewing experiences in different contexts.

We will first briefly sketch the field of recommender systems to clarify its main objectives and to elaborate on a number of relevant subdomains. Consequently, we present related work involving mainly ethnographical studies on households' television and media use. The main part of this article describes the methodology, analysis, and results of the two studies we have carried out. In Sect. 5, we combine the results of our two studies in order to strengthen our insights, compare our results to related work in order to better clarify, and expand on the different identified viewing situations. We conclude by formulating the implications of our results for the design of better recommender systems algorithms and novel interface concepts that provide a better fit with the specific viewing situations.

2 Related work

2.1 Recommender systems

The field of recommender systems explores ways to find suitable items from a large collection of items, which have applications in several domains such as travel, e-commerce, and television [1]. Well-known companies that use recommender systems in their products are Amazon and Netflix. In the beginning, this field focused mainly on how to determine people's preferences. Consequently, this information is collected in large databases and can be used to calculate suitable recommendations. The two main approaches in this regard are content-based recommendations—in which the person receives recommendations based on what he or she bought/used in the past—and collaborative recommendations—in which the person

received recommendations based on people with similar taste [2]. Hybrid approaches were developed to overcome disadvantages that are typical for the former approaches when used individually. Since the previous research lines only provide a solution for an individual, a new research question was how to offer content to a group of users by incorporating the taste and other characteristics of the different members of that group [5–7]. The different ways of providing a group recommendation involve calculating a compromise based on the tastes of the individual members of the group.

McNee et al. [8] argued that the focus on achieving the most accurate prediction for an individual or group was not sufficient to come to a usable system, a system or product that provides a good user experience. Accordingly, subsequent research focused increasingly on how to evaluate recommender systems with users, resulting in two important frameworks for the user experience evaluations [9, 10]. The model by Knijnenburg et al. [9] incorporates situational characteristics, objective and subjective system aspects, experience, interaction, and finally personal characteristics. For the validation of this framework, several trials were conducted in which participants used a particular recommender system and where the user experience was evaluated quantitatively via questionnaires. The ResQue framework by Pu et al. [10] incorporates user-perceived quality, user beliefs, user attitudes, and behavioural intensions and also uses a quantitative approach and questionnaires for validation. Both frameworks therefore fall under the positivist research tradition and aim to model the aspects related to the user experience of recommender systems. As already indicated in the introduction of this article, we argue that a phenomenological approach is complementary to the positivist approach presented above and could greatly enhance our understanding of how people consume television in the home. Consequently, this understanding allows us to improve several aspects of the systems and designs of applications that deliver video and television content to households.

While many of the studies conducted in the field of recommender systems still focus on achieving more accurate algorithms, it is important to note that other researchers have focused on evaluating the user interface of recommender systems [11]. In [11], the different ways of evaluating a recommender system are presented and discussed. One section covers how to conduct user studies with recommender systems. While this indeed goes into the direction of evaluating user aspects of recommenders, it still only mentions quantitative approaches. As such, it misses out on significant parts of the methodologies that the field of HCI can provide concerning user evaluation. Barneveld and Van Setten [12] set up a series of activities involving 19 participants in a user-centred design process focused on several aspects of recommender system's interface design: the presentation of a prediction, a mechanism for providing feedback, and explanations (that indicate why a recommendation was made, in order to increase the transparency of the system [13]). While the user-centred design process comprised a user interface analysis of existing systems, brainstorming sessions with users, prototyping, heuristic evaluation, and a usability test, the obtained results are limited in some regards. The main concern here is that the focus of the brainstorming session with users was determined via the analysis of existing user interface concepts; this means that there was no real gathering in user needs to determine the direction of the design. Furthermore, by focussing only on these predetermined interface concepts, the designs are not necessarily grounded in how people watch television at home. A study by Navarro-Prieto et al. [14] followed an ethnographic approach with interviews, a virtual ethnography, and a field observation to better understand user needs with regard to the use of interactive television (iTV) recommender systems. A follow-up study using a scenario-based approach with prototypes was used to validate the gathered user needs. This study resulted in guidelines for the design of user interfaces for iTV recommender systems. Most participants were positive towards the idea and the benefits of receiving recommendations, and most would like to have more information (metadata, a description) about the items in the system. Being able to create a profile was also considered a useful functionality; participants immediately elaborated by indicating that it would be difficult to create a profile that would be acceptable to each household member.

This section described the related work concerning recommender systems, user (experience) evaluation in the domain of recommender systems, and the user evaluation of the interfaces of recommender systems. As indicated earlier, the user evaluation methodology used in recommender systems research is still very quantitative in nature and, as such, somewhat limited in providing rich insights into the usability and user experience of these systems. Furthermore, the work on the user interface of recommender systems mainly focussed on well-known interface concepts such as presenting items on a screen and on the different forms of providing rating. Therefore, the work on recommender systems concerning TV and video content lacks a holistic foundation that is sufficiently embedded in how people actually use TV and video in everyday life. Evaluating existing interface concepts does not provide a lot of room for novel ideas, nor does it allow for grounding novel interface concepts into daily TV and video consumption. Our contribution here is that we aim to firstly establish such a foundation—a rich understanding of how people currently watch TV—and secondly, to formulate

different viewing situations in the home, so both algorithms and novel interface designs can focus on these viewing situations.

2.2 Television and video use in the home

In this section, we will review the literature that describes how television and video are used in the home; these studies are usually qualitative and are mostly conducted in the field. Therefore, they contain rich data that provide a naturalistic view on the studied behaviour. Important to note is that this section will delve deeper into the television context; we note this because this context is very specific and different from many other recommender system contexts such as online stores. While the latter are mainly used individually, television is still largely consumed in the living room. Therefore, the social context of television use is more complex.

Obrist et al. [15] report on an in situ field evaluation of a novel electronic programme guide (EPG). An EPG is a digital on-screen guide that shows what can be viewed on TV. Because it is digital, several interactive features can be added to provide useful features. In the case of personalization, the system offers useful information based on a model of what the user might need—a recommender system. In the case of customization, it is the user who can tailor the system to his or her preferences. A playful and creative approach was used to capture participants' first experiences and to discover positive and negative elements of the system. The evaluated system was not just a TV, but also allowed users to consume, manage, and organize media in the entire household. For example, the users were "able to navigate, select, and discover content by time, title, channel, genre, device". Furthermore, the EPG incorporated recommender functionality such as rating items and viewing the ratings of other members in their community. One of their insights revealed that housewives preferred to have individual profiles, mainly to ensure that the children were not able to access unsuitable content. While these results are insightful, they only "capture the users' first impressions". Furthermore, the contact with the participants was brief. In order to have a more profound understanding of actual behaviour, we carried out a three-week diary study, which provides data on a longer time period. Bernhaupt et al. [16] conducted an ethnographic study on recommendations in the living room by studying daily living habits and routines in 40 households. Their results led to several implications for the design of iTV recommender systems: a recommender system should offer novel content and provide recommendations in line with the viewer's taste and normal viewing behaviour; a recommender system should provide sufficient guidance on how it provides recommendations and how the user can steer this process; and participants preferred to have individual profiles over household profiles since they deemed the latter not realistic. These results provide very interesting insights into the actual use of recommender systems in the home and include a brief description of a number of contextual aspects that determine how people decide what to watch: time of day and personal situation. Participants also found group composition—called "viewers" in our study—a determining factor. Our contribution is that we investigate the contextual factors more in depth and that we aim to determine their relation in different viewing situations. Saxbe et al. [17] recorded the in-home activities of 30 families at 10-min intervals. Their results revealed patterns of who was watching, with whom, when, and in what location of the house. Only 36 % of TV viewing was solitary. In the remaining 64 % of the time, family members were watching together in different constellations: 17 % for the whole family; 15 % for the children; 13.5 % for mother and child; 12.5 % for father and child; and 6 % for both parents. While the actual numbers may vary between households or countries, these results point out that most time in front of the TV is spent with others, and that different constellations are involved. It is for this reason that we aim to investigate the relation between these viewer constellations and the other contextual aspects for typical viewing situations. Mercer et al. [18] focussed on determining contextual cues within the viewing situations via a multi-method, field study with 11 users of video-based content. Therefore, their research goal is very much related to our overarching research goal in this article. They were able to distinguish four archetypical viewing situations that were differentiated by the following contextual factors: solitary versus shared experiences, public versus private spaces, and temporal characteristics. We are able to confirm several of their results, but we were more elaborate in the consideration of each contextual aspect. We will revisit this in Sect. 5.

Barkhuus and Brown [19] conducted in-depth interviews with early adopters of novel television phenomena such as the use of DVRs and Internet downloading. This ethnographic study involved 21 individuals and couples in their homes. They described the uses of these novel technologies, but also captured the social role of television in the home. Important to note here is that television is the default choice for evening entertainment: typically each evening involves 2–3 h of watching television with different members of the family. They describe this part of the evening as a relaxed, inexpensive activity, where TV is not watched all the time, but is switched on. As such, it confirms the traditional role of television as described by Lull [20]: environmental uses of television in the form of "background noise", "companionship", and "entertainment". Other results indicate how people use the features

of these new technologies to better schedule the watching of video content with regard to their own needs.

In this paragraph, we will also mention two quantitative studies into viewing practices. Abreu et al. [21] conducted a survey that obtained 550 valid responses for a study into the new television viewing behaviours and practices. The results provide insight into when people watch TV: viewing occurs mostly during the evening, less so in the morning and the afternoon. In the weekend, people watch more television in all parts of the day: morning, afternoon, and evening. Their survey also indicates that people watch about 52 % together with the family and 42 % alone. Although these numbers differ slightly from the results obtained in [17], they confirm that the majority of watching television occurs in the presence of others, and less than half to one-third watched individually. Furthermore, participants stated that tips from friends or family constituted the main reason for watching certain content, followed by the promotion made by each channel. When asked about the mechanism used by a recommender system, participants preferred one based on viewing history—26 % as "very interesting" and 57 % as "interesting", followed by a mechanism based on favourite channels within the TV operator—23 % as "very interesting" and 57 % as "interesting". Interesting to note is that the mechanisms "based on profile" and "based on similarities with users with similar profiles" were not considered that interesting. We assume that this can be explained by the method used—a survey—to investigate this aspect; "based on similarities with users with similar profiles" is something that needs more explanation and demonstration before a non-expert could grasp what it could mean for him or her. The final aspect of this survey that we would like to mention here concerns the criteria that determine how people decide to watch in descending order of importance: programme genre, state of mind at the moment, being alone or accompanied, and available time. In comparison with the survey conducted in [5], we use a more qualitative approach in order to provide richer insights into the manifestations of those contextual aspects in the home. Another quantitative study by Chaney et al. 22 uses a data-oriented approach that makes use of a very large data set containing more than 4 million logged household views [21]. The study reveals how the viewing varies by who is watching and type of content, and how the viewing patterns change when the group context changes. The results show that more than 80 % of co-viewing occurs in groups of two people; for larger groups, the amount of programme views is substantially lower. This is also in line with [17]. The authors also present distributions of the views across genres by age and gender. For example, the amount of news watched increases with age for both men and women. For sports, however, women have a very low number of views across all ages, whereas men peak in views between 20 and 30 years of age; the number then gradually lowers with older age. Individually, women tend to watch more talk shows, drama, and music, whereas men prefer animation, documentaries, and sports. They also show some insight on the role of programme genres for group viewing: more than a third of the group views came from quiz shows, drama, and sports, whereas only music, news, and politics only account for about 20 % of the viewing in group settings.

Our contribution in this article is that we aim to further expand and describe the relation between the different contextual factors that determine how television is watched in the home, by combining insights from our studies and important findings in related work. When considering the main goal of recommender systems for TV and video—helping the user to find suitable content in a large collection of items—it is important to know what factors determine how people decide what to watch in everyday life. Based on the related work that identified relevant factors [5, 16–18, 21], we utilize the following contextual aspects in our second study: time (time of day, day of the week, the meaning of certain moments to the viewer), mood (the state of mind of the viewer at the time of watching), content (genre, duration), and viewers (structure of the household, composition of who is watching, relation between the family members, and who is watching a programme). After looking into these relations, we determine how these constitute different, situated viewing experiences in the home. These insights allow us to discuss how this understanding of households' viewing experiences can help define the role of recommender systems and open up new avenues for user interface design.

3 Study 1: naturalistic viewing behaviour in the home

3.1 Goal

Our goal in Study 1 is to establish a thorough understanding of how people use and view television and video in their everyday life. This study is therefore focused on charting and understanding naturalistic viewing situations in the home. The research questions are:

- How do these viewing activities unfold in the context of the household?
- What kind of programmes do they watch?
- How are the groups composed in the different viewing instances?

Partial results of this study were published earlier in [23], where we reported results pertaining to second-screen use. As explained in the related work section, we aim to

gain a thorough understanding of how people watch TV in the home and how they decide what they will watch on different occasions. Furthermore, we aim to derive the determining factors that play a role in these activities.

3.2 Method

For this first study, 12 households were recruited in and around the cities of Antwerp, Ghent, Hasselt and Leuven in Belgium, and asked to complete a diary for a three-week period. After the diary period, a researcher visited these households to conduct in-home interviews using the completed diary for elicitation. The households comprised three singles, two young couples, two young couples with very young children or babies, and five larger families with children. Recruitment was spread via convenience sampling, social media, and the university newsletter. A 100 € gift certificate was provided as incentive after participation in the study.

A diary study captures specific activities and experiences over a certain period of time. Therefore, the resulting data are very rich and can unveil different patterns in household members' activities. Because activities are noted each day, participants do not have to rely entirely on their memory during the interviews after the diary period, increasing the reliability of the data. The dairy thus mainly serves as an elicitation tool during the interview [24]. We designed a booklet with A5-size pages, which is ideally suited for lying around in the neighbourhood of the television during the diary period. The first pages provide information about the goal of the study, instructions for the participants, basic demographic information, television and video preferences, and the equipment used in the home. These first pages only had to be filled in once at the start of the diary period. The main part of the diary contains pages in which participants were asked to record their television and video watching activities (see Fig. 1); they were asked to include any kind of TV or video content on any device. For each day, two pages were foreseen, in which details about the programme, location, devices, co-viewers, interlocutors, and the participants' state of mind could be provided. These entries are important for our research as they were discussed extensively during the interviews. These semi-structured interviews were held at the participants' homes and lasted approximately between 30 and 90 min; interviews with larger families usually lasted longer than the interviews with singles. For structuring these interviews, we went through the recorded diaries and engaged in a discussion about their entries. These conversations enriched the data to a great extent. An interview guide was also created to make sure all topics were covered. After transcribing the recorded interviews, a grounded theory approach was used to organize the data. The interview transcripts were coded extensively in three iterations.

3.3 Results

Our qualitative study resulted in a large amount of rich information. An overview of the high-level concepts is presented in Table 1. In the following subsections, we will present the relevant aspects for this study and thus focus on a selection of these high-level themes. Furthermore, qualitative software packages such as NVivo allow us to look for overlap between themes, which can also reveal important relations between the themes in our study. Important to note for interpreting Table 1 and the following results is that this still remains a qualitative study. The number of references might be an indication of the importance, but one has to be cautious when making quantitative inferences. In addition, not all the themes in Table 1 are relevant to our research questions in Study 1; the results will therefore mainly a subsection of these themes.

3.3.1 Content in relation to viewing mode

In this section, we present the results relating to two concepts: the kind of content participants were watching and the viewing mode. Firstly, the topic content contains the following subtopics in our data: DVDs, lighter genres, movies, news, and short movie clips. With "lighter" forms of television programmes, participants indicated programmes such as quizzes, game shows, reality TV, and comedy programmes. They employed this term to indicate that this kind of content does not require a lot of attention. Secondly, viewing mode has been addressed in earlier studies [25] and refers to the amount of attention allocated to the programme. With "dedicated" we mean programmes for which the participant really focuses on the programme; "mixed mode" implies that the attention shifts occasionally between the programme and other activities; "background" refers to the use of the TV as background and where there is usually no focus at all towards the programme.

A first observation in the data is that we found 17 instances were mixed mode (viewing mode) overlapped with lighter genres (content). Although this is a qualitative study, and therefore the number itself not that important, these instances indicate that a significant amount of viewing activities in the home involve watching lighter forms of television programmes, where the focus occasionally shifts from the programme to other activities and back again.

> For So You Think You Can Dance I really want to see the dancing performances, but the comments of

Fig. 1 Sample diary pages (in Dutch) to aid the participants, showing the different parts: what participants are planning to watch (*on top*); what participants actually watched including time, duration, programme name, *first-screen* device, *second-screen* device, how and with whom participants were communicating (diary entries)

Table 1 High-level themes derived from the data together with a concise description of each theme

High-level theme	Description	Sources	References
Devices	All devices used by participants to watch TV/video	12	187
Content	Genres, duration, and other aspects related to content	12	158
Motivations	Why participants watched video/TV	11	113
Second-screen uses	When and how second-screen devices were used	11	104
Togetherness	Instances in which participants referred to the importance of being together in the home	12	99
Everyday life	How situations in daily life influence TV/video viewing	12	93
Locations	Locations where TV/video was watched	12	87
Watching behaviour	The extent to which viewing was planned, spontaneous or routine	12	84
Viewing mode	The amount of attention participants were paying to the programme, from completely engaged to the use of TV/video as background	11	75
Mood and emotions	The states of mind when watching TV/video and resulting emotions during or after watching TV	11	24
Diary use and feedback	Participant feedback regarding the use of our diaries	7	15
Quality	Statements about image and sound quality	9	15
Discovery	How participants discovered new content	7	9
Bad TV habits	What participants themselves described as negative behaviour in relation to TV/video viewing	4	8
Social media	How and when social media was used alongside TV/video use	2	8
Digital TV	Statements relating to digital TV products used	4	5

"Sources" describes the number of households in which the data were found; "references" equals the number of instances in the entire data collection

> the jury, what they did the past weekend, how their sister grew up, how the campaign for that participants had run, really does not interest me. So that's the moment you start doing [other things]. Father 30

> And then I watch Komen Eten [a Flemish reality TV show about cooking] to relax, and also a little bit to get that Big Brother feeling: "I'm watching you." Because during Komen Eten, I can do a lot of things:

> it is always the same format, always very light, and I can easily check my Facebook status. After I come home from work I tend to take care of some private stuff such as emails and administration. Single woman 34

Important to note here is that certain kinds of content, the "lighter" genres that do not require that much focus such as talk shows, reality TV are suitable for engaging in other activities. Sometimes, participants consciously choose to watch these lighter genres, so they can occasionally engage in other activities. On the other hand, content forms such as movies, usually require a more of attention:

> For me it is cosiness. I don't really know of a program that is so important to me for me to really sit down. Only when we are watching a movie, then we are really into the movie. Mother 47

The above results shed light on the relation between two important factors: the content and the amount of attention. There are many different genres of TV and video content, but a main difference seems to be how much energy people have to spend following the programme. "Lighter" types of content allow people to engage in other activities and tune back when something relevant happens. The relation goes both ways: when watching lighter types of content, people are more easily distracted; sometimes, people deliberately choose to watch those lighter types of content in order to be able to engage in other activities in the home. Another important aspect to note here is the role of time, more specifically, the watching of lighter genres on TV when coming home from work. At such moments, people have a number of personal and household issues to take care of. Tuning the TV to watch lighter formats allows them to do so. Therefore, we conclude that it is important for recommender systems to make the distinction between lighter genres and more demanding genres when calculating and offering suggestions to the viewer.

3.3.2 Content in relation to watching behaviour

We have created the category watching behaviour during our coding process to indicate the difference between planned viewing, routine viewing, and spontaneous viewing. In our data, we found seven instances of overlap between movies (content) and planned (watching behaviour), and ten instances of overlap between lighter genres (content) and spontaneous (watching behaviour). These data suggest that movies require planning, or that participants prefer to schedule this kind of content, and that for lighter genres, this does not really matter that much. The latter type of content can always be started or stopped, or, as indicated in the previous section, people can engage in several activities in the home while this content is shown.

> Currently we have the habit of watching a movie together on Friday or Saturday evening. Mother 47

The implication for recommender systems here is that, again, the distinction between lighter content and more demanding content is important, that the programme duration plays an important role when making a decision of what to watch, and that recommender should certainly provide sufficient support/information for viewers when they are planning to watch longer form content.

3.3.3 Structure of the household

In the previous section, we noted that the viewing for certain types of content is planned. Some explanations for this are related to the structure of the household: being a single, a couple, having very young children (babies), or a larger family with children of different ages. One mother of very young children illustrates this:

> I like to watch movies. But I really have a narrow window to decide whether or not I will watch a movie. [Her baby girl] goes to bed at eight. If you don't start watching a movie before nine, you are too late because we want to be in bed at half past ten, since we have to get up at six. So you only have an hour to decide, and if something happens in this hour or you have to do something for work, this block is not long enough. Then, I just don't watch TV. Mother 31

For a larger family with somewhat older children more elements are relevant such as children who also watch television, and the role of school and work. The following, somewhat longer excerpt, sketches how the television activities unfold in such a household:

> Mother 45: In the weekend especially father and son are watching. They usually record programs on Saturday, and on Sundays they watch sports.
> Daughter 18: During supper, or just after supper, my little brother watches Ketnet [a channel of the Flemish public broadcaster dedicated to children], and usually we watch along.
> Mother 45: We tend to eat here [the interview was conducted at the dinner table in view of the TV]. So when something is on [TV], it stays on. We won't turn on the TV especially for supper, but if it's switched on, it stays on.
> Daughter 18: From the news onward, it usually stays on the whole time.
> Interviewer: And who has a job during the day?

Mother 45: I do, my daughter and dad. He is currently at home, due to sick leave for 3 months now.
Interviewer: And at what time do you normally arrive from work?
Mother 45: 16 h
Son 9: daddy at 18 h
Daughter 18: I arrive between 16 and 16.30 h.
Interviewer: Do you watch TV between arrival and supper?
Mother 45: He [referring to the son] can sometimes do this, when his homework is finished, and when he doesn't have to do any other chores.

This excerpt highlights the moment of the day where everyone arrives from either home or school, at different times, and supper. Different members of the families arrive at different times. During this time of day, the family is waiting for everyone to arrive and then starts arranging everything for supper.

The above results indicate the importance of the structure of the household. Not only does this impact the viewing activities when arriving from school or work, it also determines what people can see within certain time constraints. The important contextual elements here are time (available time, moment of the day), viewers (the different members in the household), and the content (duration of the programme).

3.4 Main findings from Study 1

In the first study, we elaborated upon the daily viewing context in the home. The important aspects to consider related to our overarching research goal are that the type of content is very much related to the amount of attention given to the programme, that certain content is consciously planned for viewing, and that the household characteristics significantly define the place for television viewing.

In contrast to the mainly quantitative approaches used in recommender systems research, investigating the impact of very little factors using a large data set in order to come to statistically meaningful results, we looked at the issues from a holistic perspective. In other words, we identified the different relevant factors that determine TV/video viewing in households, and we looked at how these factors relate to each other. Firstly, the traditional classification of content into genres such as drama, thriller, reality TV is certainly useful, but a more defining characteristic of content is the whether or not it requires a great deal of attention in order to consume it. Secondly, the former aspect also relates to the duration of the content: usually, formats that require more attention are more likely to be longer formats such as drama series and movies. Finally, the way the time is divided in the households also influences TV viewing. It determines who will, or is allowed to, watch the kinds of programmes that are watched, and for which constellation of viewers a compromise has to be sought.

After this broader study focussing on different aspects that determine how video and television are consumed in the home, we investigated more specifically how different contextual elements come together in typical viewing situations (Study 2).

4 Study 2: exploring four contextual factors determining household viewing situations

4.1 Goal

In this study, our goal was to identify and elaborate on the contextual aspects that comprise typical viewing situations. Consequently, our research questions are:

- What are typical viewing situations in the home?
- How do the relevant contextual aspects unfold in each of these situations?

We use the contextual aspects that determine viewing behaviour derived from [5, 16–18, 21]: time (time of day, day of the week, the meaning of certain moments to the viewer), mood (the state of mind of the viewer at the time of watching), content (genre, duration), and viewers (structure of the household, composition of who is watching, relation between the family members, and who is watching a programme). We deliberately employed broader meanings concerning time, mood, content, and viewers to ensure that participants' contributions were as complete as possible. Furthermore, related work focused on some of these contextual elements, or on specific subsets thereof (for example, only "time of day" with regard to "time").

4.2 Method

We recruited eight families consisting of households with children. The reasons are twofold: the second study was conducted in cooperation with a broadcaster that was specifically interested in this constellation, and calculating recommendations in a household with children is likely to be the most complex. A first phase of this study involved a limited diary study: participating households were asked to record their viewing (TV, recorded programmes, DVDs, and video-on-demand) practices at home for two weekdays and two weekend days. This information was then used in a second phase that consisted of a workshop wherein we wanted to uncover how the criteria of how people decide watch television were related to each other. The workshop was held at two different days, each day with four

households because that was the limit for being able to facilitate such a workshop. One family participated in the diary study, but was unable to come to the workshop; therefore, these data are not included in the analysis.

Compared to the Study 1 in which 3 weeks of diary entries were collected, this study only considered diary data collected over 4 days. This decision was made for two reasons: Study 1 already provided more reliable data on household TV and video watching activities, and in Study 2, we wanted to identify and elaborate on typical viewing situations or experiences. Therefore, Study 2 relied somewhat more on memory than on actual behaviour. In Study 2, we asked households to make sense of their viewing experiences making use of the considered contextual aspects of time, mood, content, and viewers. Using retrospective methods to investigate user experiences is not uncommon and gaining ground in the HCI community [26]. Furthermore, it is also in this regard that Study 1, where the focus was more on elaborating actual viewing behaviour, and Study 2, where the focus was more on making sense of viewing experiences, were complementary.

The workshop format was as follows: at first, participating families were each seated at one of four tables (see Fig. 2). On each of those tables was a large (flip chart-size) sheet of paper with one of the following themes: mood, content, viewers, and time. At each table, participating families were asked to write their diary entries relating to that theme on post-its and provide some more contextual information (see Fig. 3). After approximately 30 min, families moved to the next table, which contained another theme; this rotation occurred four times so that each family provided input on all the themes. After a short break, participants were invited back into the room. During the break, we had gathered the large sheets from the tables and attached them next to each other to the wall in front of the room. Each family was again seated at a table. Now they were asked to gather post-its from the four different themes and move them into clusters. This means that participating families were linking contextual information relating to each theme together, specifically in the way that it occurred in their homes (see Fig. 4). Finally, after they could not find any more applicable clusters (that each make up a situation), they were asked to present their viewing situations to everyone, and by using these clusters, explain in more detail what each collection of contextual aspects meant in their situation. After the presentation, we organized a discussion with the researchers and the other families about what was just presented, more specifically to clarify certain statements or to make comparisons with situations in other families. These presentations were videotaped and transcribed. For analysis, we first placed the different clusters in a spreadsheet and organized the information of all families according to the four themes—mood, time, content, and viewers. By sorting the information via each theme separately, we were able to explore the information and identify similarities across the families. After identifying these clusters, we consulted the transcripts to read what the families explained about these situations. These descriptions helped us to formulate the viewing experiences for which we could link different manifestations of the contextual factors. For the verification of the information about the specific contextual factors, we consulted the diaries again.

Fig. 2 Four tables: each one contains a large sheet of paper with one of the four themes: time, content, viewers, and mood

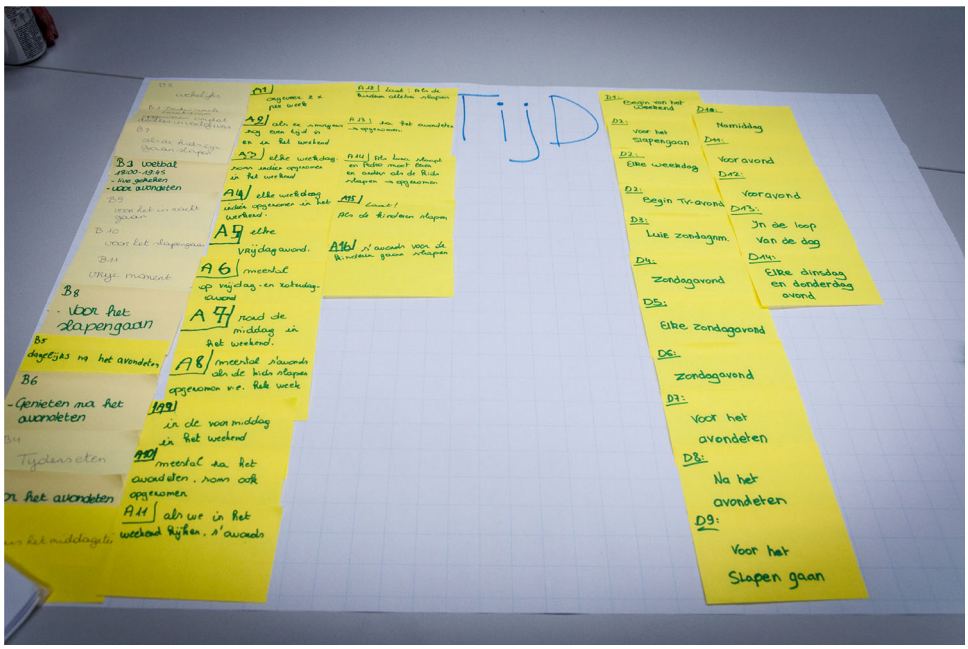

Fig. 3 Post-its on the paper sheet for the contextual element "time" during the workshop. Each post-it contains a *letter code* to indicate the different families and a *number code* to indicate each diary entry. This allowed us to trace each post-it back to its original source

Fig. 4 Participating families gathering post-its from the four themes, to form combinations that resemble the viewing situations that occur at their home

4.3 Results

In Table 2, we present the high-level overview of the results. In the first column, we have given each viewing situation a descriptive name taking into account all the related data. The remaining columns each indicate the different manifestations of the key contextual factors. In the following subsections, we will describe each viewing situation in more detail.

4.3.1 Weekend mornings

A first important viewing situation in our data concerns "weekend mornings". During weekends, the morning is typically a moment of quiet and peaceful awakening for five out of seven participating households. The households that did not indicate this moment had older children. At this time, younger children start watching TV or video. They mostly watch programmes for children or channels

Table 2 High-level overview of the viewing situations and the related manifestations of key contextual elements

Viewing situation	Mood	Content	Viewer	Time
Weekend mornings	Happy, cheerful, fun—relax, lazy, awakening	Music programmes, shows for children, comedy	Children	Weekend mornings
When the children are sleeping	Relaxing, tired—exciting, addictive—cheerful	Soap—TV series—movies, comedy	Parents	Late evening
Family quality time	Relaxing, fun, laughing together, good mood	Comedy, reality TV, hidden camera, soap, movies	Family (in different constellations)	After supper
Relaxing after school	Relaxing, cheerful, good mood	Shows for children, animals, exciting drama series	Children	After school, before supper
A free moment	Emotional, exciting, cheerful	Reality TV, drama series, emotional content	Mothers mostly	A free moment during the day
Men and sports	Relaxing, lazy, resting	Sports (fixed sports shows, live sporting events)	Sons, fathers	Depending on the sporting events
Lazy afternoons	Relaxing, lazy, resting, laughing together	Comedy, shows for children	Movies, sports, recorded programmes, hidden camera	Weekend afternoons, a day off during the week

dedicated to broadcasting programmes for children. Other content types consumed during these viewing situations are comedy and musical shows. In one case, the diaries also mentioned that the mother was watching TV together with her children. So, it is usually the children who are watching, because parents are engaged in household activities, or are still sleeping.

> Our daughter usually watches television in the weekend; we usually sleep a little bit longer. She turns on the TV and Studio 100 [a company creating products and experiences for children such as toys, TV series and a theme park] to start dancing and jumping and singing. We can hear her even upstairs [in the parents' bedroom]. Our daughter just gets up, is right awake and becomes very active. And she is always in a good mood, as you can see. Mother 33

When we look at the state of mind, or mood, we find that the participants use two seemingly opposing sets of words: happy, cheerful, fun on the one hand, and relax, awakening, and lazy on the other hand. The latter set seems more obvious as people are waking up. The former is attributed to the state of mind of the children who are watching, although they too sometimes refer to an easy-going state of mind. This viewing situation is not restricted to the weekend; it can also occur on certain days during the week, for example on a national holiday.

> Then, the children are watching without mommy. This happens mostly on a morning on a day off when we don't have to be somewhere at nine. I'm very tired, whereas they [referring to her young daughters] are already very active and full of energy. So, they can go and watch TV if they don't fight. And then they watch programs for children because they are still very young. Mother 33

The situation "weekend mornings" is a specific viewing situation mainly defined by the contextual aspects time, viewers, and content. Mood is harder to use as a distinction between viewing situations as most reported states of mind refer to some form of relaxation. In addition, participants round mood quite difficult to put into words. When we look at time, it is important to consider that this viewing situation is defined not only by time of day, but also by time of the week. Viewers in this case usually refer to younger children; however, sometimes a parent can be present as well. Finally, the content type associated with this viewing situation is very much defined by its viewers: mostly programmes for children, comedy or musical shows.

4.3.2 When the children are sleeping

This viewing situation involves parents who are watching television when their children's bedtime has passed. They can then watch content that is closer to their taste, since earlier in the evening compromises have to be made with the whole family.

> Mommy is usually alone when the children are sleeping. Then, I'm usually very tired and in need of some relaxation. Therefore, I tend to watch thrilling drama series. Single mother 33

> In the evening during the week when the children are in bed, mom and dad are watching all kinds of TV: relaxing, series, music, movies, and entertainment. So it is relaxation, or because of a certain interest, usually watching without having to pay a lot of attention. Mother 45

> When the children are sleeping late in the evening, I usually watch series that consist of many seasons

with my husband: Sons of Anarchy, Breaking Bad. This [type of content] is not suitable for our children, but it is very addictive for us. We find this relaxing and exciting at the same time. Mother 33

The situation "when the children are sleeping" is a specific viewing situation mainly defined by the contextual aspects time, viewers, and content. As stated earlier, mood is harder to use as a discriminating factor; however, when we look at what emotion participants mention related to the content they are often watching, we have to note that "addictive" or "exciting" is very much related to this viewing situation. When we look at time, it is important to consider that this viewing situation is defined not only by time of day, but also by a certain meaning of time, namely when the children have gone to bed. At this time, no more compromises have to be made with all the family members, so parents can choose more adult content and more specific content to their taste. We also have to note that at this time compromises between the parents still have to be made. Furthermore, the fact that the children have gone to bed means that this situation is also more associated with peace and quiet. Viewers in this case refer to one or both parents. Concerning content, participants usually watch drama series, soaps, movies, and comedy.

4.3.3 Family quality time

After supper, the whole family watches TV together. As such, they try to watch content that is enjoyable by all members of the family. This entails a broad range of different programme genres: comedy, reality TV, hidden camera, soap, and movies. In general, these are the more "lighter" programme genres. Typical for this situation is also that family is enjoying being together; the focus is less on the content. The atmosphere participants described in this situation is relaxing, fun, laughing together, and being in a good mood.

On Friday evening we usually watch, if the father does not have to work, The Voice, or Britain's Got Talent. We find it very relaxing and funny, especially during the early rounds. We always watch this together, even if the father is working, then we watch with the three of us. Mother 33

As a family we mostly watch soaps after supper as relaxation. My two sons like to watch football together, which they mostly view live on a laptop. This can occur before or after supper. They find it relaxing. My daughter and I regularly watch a recorded movie, usually a very sentimental movie; that's typically female I guess. Mother 41

The viewing situation "family quality time" can be defined by all the contextual aspects. Central to this situation is an atmosphere in which the whole family is together in the living room and enjoy socializing. All the family members are the viewers. As such, the viewed content must allow for everyone to enjoy this moment, or even for the content to stimulate such moments. A broad range of lighter content types such as comedy, reality TV, or hidden camera is ideal for this situation. Finally, also time determines this situation: after supper (time of day), when the children do not yet have to go to bed (meaning of time).

4.3.4 Relaxing after school

After children come home from school, they need to wind down a little bit. Therefore, they like to watch some content that is not too demanding. This mostly happens after school and before supper. They want to relax and get into a good mood.

So the first [cluster] is after school. I am finished early with school so after school I can watch the programs they don't like. Then, I usually watch thrilling series to relax; I don't think too much and forget all about school [making a throw-away gesture while making this statement]. Daughter 19

After school, and then we mean after their homework is finished, then there is a moment of… [makes a gesture to indicate "relax, ease down"] cooking and other chores. At those moments I just say, probably to make it easier for myself: "go watch some TV". Then, I can prepare everything. So they watch programs and movies for children. Mother 45

The viewing situation "relaxing after school" can be defined by all the contextual aspects. This situation is very much determined by time: time of the week (school days), time of day (after school), and the meaning of time (children want to forget about school and relax). This meaning of time automatically explains the reported moods. The content watched during this viewing situation is meant for children and should provide some relaxation: TV for children, shows with animals, exciting show, and drama series were mentioned. Finally, schoolchildren are the viewers.

4.3.5 A free moment

This situation involves mothers who at some point throughout the day have a moment for themselves in which they usually catch up on some recorded content. Sometimes, however, it involves both parents. Then they watch

reality TV and drama series. This can happen during the weekend or on a day off.

> Yet another moment in the weekend is when the children are off to the "Chiro" [organisation for youth, similar to the Boy Scouts] and we, mom and dad, think… [makes a gesture to indicate "relax, ease down"], Sunday afternoon, the children are gone, lets settle into the couch. Mother 45

> Almost everything is recorded in our home. For example during the Easter vacation when the weather is nice and the children are playing outside, than it happens that I start watching TV. Mother 33

> In our case there is not dad, so it is just mom. During the day when I have to do some ironing, which does take a couple of hours every week, I am reasonably cheerful, or it make sure I get in a better mood by the TV, so I watch those "emoseries" or reality TV. Single mother 33

This viewing situation, "a free moment", is mainly defined by the viewers. In our study, this concerned housewives who at some point in the day wanted to relax when a free moment presented itself during the day. When we look at time, we notice that time of day was mentioned but is quite broad and difficult to predict—at some point during the day. The mood was described in relation to the meaning of this moment: wanting to relax during a day of activities at home. The viewed content here involved reality TV, drama series, and emotional series. Concerning the viewers, sample is probably somewhat limited as it does not contain any housemen.

4.3.6 Men and sports

The viewing of sports-related content was in our data entirely done by men. This happens mainly during the live sporting events, or on fixed moments. In the latter case, it often concerns television shows that review the recent sporting actuality.

> Son 17: "Yes, we don't always watch on TV: we can view some [football] matches on laptop because on TV I would have to pay for it and on a computer you can just watch it."
> Researcher: "and if you would be able to watch on TV?"
> Son 17: "Then I would rather watch on TV, that's easier."
> Dad watches sports on Sunday night and finds it relaxing. Mother 41

The content is the main factor determining this viewing situation and concerns all types of sports-related content: weekly shows that provide an overview of the latest news and summaries, and live sporting events. It is difficult to establish a specific time of day or time of the week for this situation. The time aspect depends entirely on the broadcasting of sports-related content. The viewers were fathers and sons. Here, our sample is probably limited since there are obviously men who do not watch sports and women who do.

4.3.7 Lazy afternoons

The final viewing situations we describe here are lazy afternoons. The viewers in this situation can be any combination of the family members. Therefore, the content watched is also diverse: comedy, shows for children, movies, sports, hidden camera, etc. Most of this content is recorded via a DVR. It concerns weekend afternoons, but can also include an afternoon during a day off or national holiday. Because this situation occurs in a moment of free time, the mood is often very relaxed, and when more family members are watching together, these moments also meant to spend some time together.

> On a day off, or on a Wednesday afternoon [when there is no school], we often watch a movie together with the whole family. Then we are in a good mood. It is either a DVD or something from the [VoD service], or a movie we have recorded earlier. Single mother 33
> Researcher: "I see a lot of free moments. When do they occur?"
> Mother 45: "I stay at home, I don't work so I have more free moments than working people. Then I like to watch, as my family would say…"
> Then I like to watch, as my family would say..."
> Son 17: "a terrible show!"
> Mother 45: "I really cannot watch this when somebody else is at home, so I have to watch it then. At those moments I can relax…"

The final viewing situation "lazy afternoons" is not easy to define by precise manifestations of the contextual aspects. Time of day (mostly afternoons) and time of the week (weekends and holidays) are characteristic for this viewing situation. Concerning the meaning of time, we can say that this concerns an entire day without many obligations, which allows for killing some time, socializing, and catching up on recorded TV or video items. The mood is mostly described as relaxing or socializing. The viewers and the content can be quite diverse. Many constellations of households and many content types were reported in this instance.

4.4 Main findings from Study 2

The results of Study 2 identify seven different viewing situations that are determined by specific manifestations of the contextual aspects time, mood, content, and viewers. Some of the contextual aspects have different ways in which they manifest themselves. We found time of day, time of the week, and a meaning of time as important subtypes of the contextual aspect time. For content, we refer to genre, lighter versus heavier content, and the duration of the programme. Viewers resemble different constellations of the household: the children, the parents, the whole family, a housewife, and sons and fathers. These viewing situations are not exhaustive, but form the most common viewing situations across the participating households in our study. We elaborated on seven typical viewing situations: weekend mornings, when the children are sleeping, family quality time, relaxing after school, a free moment, men and sports, and lazy afternoons. Furthermore, we were able to relate each viewing situations to a specific combination of four contextual aspects: time, mood, content, and viewers.

5 Discussion

In this section, we will first discuss how insights from both studies can be combined to augment the obtained viewing situations in Study 2. Then, we will compare our results to related work. After this, we will discuss the implications of our research with regard to the construction of recommender systems for TV/video and to the design of novel user interfaces. Finally, we will clarify the limitations of our work.

5.1 Combining insights from both studies

Study 1 provided an understanding of the main contextual aspects regarding watching TV/video and deciding what to watch in households that was generated from a large set of data on viewing behaviour. Study 2 employed an inverse approach: by combining important contextual aspects identified in the literature, typical viewing situations were composed and described. Two aspects of Study 1 still need to be allocated to the viewing situations from Study 2: the content delivery type—broadcast versus any form of VoD—and the viewing mode—dedicated, mixed mode, or background. This was achieved by going back to the data of both studies and looking for instances where these aspects were mentioned. The resulting and more complete viewing situations can be viewed in Table 3.

As stated in the introduction, the goal of our research was to identify typical viewing situations and investigate how different contextual aspects are related to each of these viewing situations. This knowledge allows us to design recommender systems and interfaces that better fit the actual viewing situations in the home. One example of such an improvement could be to provide content for children on weekend mornings based on the respective children's preferences and to provide a suitable and playful user interface with easy-to-use and basic functionalities.

We identified seven typical viewing situations: weekend mornings, when the kids are sleeping, family quality time, relaxing after school, a free moment, men and sports, and lazy afternoons. For each of those viewing experiences, we were able to derive important manifestations of the following contextual aspects: time, mood, content, viewers, content delivery type, and viewing mode. Important to note is that by applying a broad perspective on the main contextual aspects in Study 2, some of these aspects have specific subsets. For time, we found that time of day, time of the week, and the meaning of time are distinct subsets that can help identify a viewing situation. Concerning content, we made distinctions based on genre, and on the fact that certain content is easier to follow—the lighter formats such as reality TV and comedy—and other content require more effort—drama series and documentaries. Concerning viewers, we have many constellations of a household: parents, children, housewives, parent and child, father and son, and the whole family. For content delivery type, we have made the distinction between traditional broadcast TV and any form of VoD. Viewing mode, indicating how much attention is paid to the content, consists of dedicated viewing (where people are fully engaged in the programme), mixed mode (where people switch their attention from the content to something else and back), and background. These viewing modes do not form absolute categories; it is important to consider the amount of attention paid to the content as a continuum. Finally, mood forms the most difficult contextual aspect since participants found it hard to formulate. It is hard to distinguish the viewing situations based on mood alone.

5.2 Related work

The results of our studies fall mainly into the scope of studies related to television and video use in the home (see Sect. 2.2). [15] and [16] report on evaluations of recommender systems in people homes. We mentioned earlier that in [15], the contact with the respondents was very brief; the relevant conclusions are therefore somewhat limited. The study reported in [16] involved the evaluation of a recommender system in the field. One of the recommendations stated that recommendations should be in line with people's tastes and their normal viewing behaviour. In our study, we specify in more detail how a recommender

Table 3 Complete overview of the seven viewing situations characterized by six contextual aspects

Viewing situation	Mood	Content	Viewer	Time	Content delivery type	Viewing mode
Weekend mornings	Happy, cheerful, fun—relax, lazy, awakening	Music programmes, shows for children, comedy	Children	Weekend mornings	Mainly broadcast	Mixed mode
When the children are sleeping	Relaxing, tired—exciting, addictive—cheerful	Soap—TV series—movies, comedy	Parents	Late evening	Mainly VoD	Dedicated
Family quality time	Relaxing, fun, laughing together, good mood	Comedy, reality TV, hidden camera, soap, movies	Family (in different constellations)	After supper	Mainly broadcast	Mixed
Relaxing after school	Relaxing, cheerful, good mood	Shows for children, animals, exciting drama series	Children	After school, before supper	Mainly broadcast	Mixed
A free moment	Emotional, exciting, cheerful	Reality TV, drama series, emotional content	Mothers mostly	A free moment during the day	Mainly VoD	Dedicated
Men and sports	Relaxing, lazy, resting	Sports (fixed sports shows, live sporting events)	Sons, fathers	Depending on the sporting events	Mainly broadcast	Dedicated
Lazy afternoons	Relaxing, lazy, resting, laughing together	Comedy, shows for children	Movies, sports, recorded programmes, hidden camera	Weekend afternoons, a day off during the week	Mainly VoD	Dedicated, mixed mode

can achieve this by taking into account the manifestations of the contextual aspects in each viewing situation. The survey conducted in [21] investigated which factors determine how people decide what to watch and their relative importance. Our qualitative study was able to elaborate on what these contextual aspects entail in the context of TV and video watching at home. Furthermore, we were able to specify the manifestations of each of those factors and to find how each viewing situation is related to specific viewing contexts. The study conducted in [17] was different in scope: their specific methodology allowed for making (quantitative) determinations of the proportions of TV viewing for each constellation of household members on all viewing time.

An important related work is [18] in which contextual cues within viewing situations were investigated. Whereas they identified four viewing situations, we arrive at seven different viewing situations. The reason for this is twofold: we considered more contextual aspects, and we provided more granularity in the manifestations of each contextual aspect. Their contextual cues include solitary versus shared experiences, public versus private spaces, and temporal characteristics. Our contextual aspects provide more granularity concerning the sharing of experiences; we determine very specific constellations in the households for each viewing situation. Furthermore, we specified the temporal characteristics—or time—in several subtypes and identified the different manifestations thereof with regard to each viewing situation. Our subtypes related to time include time of day, time of the week, and the meaning of time. The granularity in our results concerning time of day is higher; we make an important distinction between weekdays in which family members have important obligations such as school and work, and weekdays and holidays, in which more time is available for leisure. Concerning the identified viewing situations, we notice that we have defined "family quality time" differently than [18] who use "quality time". As they refer to the time of day when children have gone to bed, they refer to quality time for the adults in the households. The viewing situation "when the kids are sleeping" in our study is probably equivalent to "quality time": the situation occurs later at night when parents can choose content that is closer to their taste, which results in more engaged viewing; usually the adults tend to consume recorded or on-demand content. In sum, by incorporating more contextual aspects and providing more granularity, our viewing situations allow for a better match between a recommender system and the context of use, since more elements are available to make such determinations.

Our results confirm the important contextual aspect "viewing mode". In the literature, it is named differently—

ambient versus focused watching in [19], engaged versus unengaged in [18], but they point to the fact that certain content requires, and is watched with, more attention than other types of content. Our contribution here is that we were able to relate these viewing modes to the different viewing experiences. Furthermore, [19] provides a detailed insight into novel uses surrounding, at the time, novel TV technologies. Whereas they provide rich, contextual descriptions of these phenomena, their results do not include a determination of different viewing situations based on contextual aspects as in Table 3.

Concerning future work, we should engage in an effort to combine our qualitative approach with more quantitative approaches such as [21]. Their results are based on a huge data set and involve similar contextual aspects such as viewers, content type, and group contexts.

5.3 Implications for recommender systems

When thinking about the implications our results have for recommender systems, we believe that they should aim to predict typical viewing situations based on the different contextual aspects that are associated with each situation. The contextual elements, and their manifestations in the different viewing situations, allow recommender systems to provide a set of items that is better tailored to each situation. For example, it is not useful to offer documentaries to children when they are just home from school. Documentaries require a significant cognitive effort; as such, this is incompatible with this viewing situation in which these children are trying to relax and forget about school. After supper, it is good to provide a diverse set of items from genres that are more lightweight and allow for laughter and socializing for the whole family. Our contribution in relation to the more traditional recommender systems research is that we now provide a more holistic understanding grounded in naturalistic viewing behaviour, an understanding that includes several contextual aspects and subtypes simultaneously. As stated in Sect. 2.1, traditional recommender systems research usually focuses on one or a few aspects at a time: different ways of providing group recommendations are compared (related to our aspect of viewers), or the performance of contextual recommendation algorithms incorporating time is evaluated, etc. By combining insights on all contextual aspects that determine a viewing situation, certain genres or types of content can be excluded in situations in which they do not make sense. Such a recommender system would be able to offer a set of items that forms a better fit to the respective viewing situation. Netflix, for instance, makes use of different user profiles. Based on the viewing history—implicit information—and ratings by the user—explicit information, Netflix offers interesting content recommendations for the respective user profile. The idea of using different user profiles was also suggested by participants in the field studies on recommender systems [13, 15, 16]. Therefore, one improvement of recommender systems is to construct profiles not related to the different users, but related to these viewing situations.

For group recommender systems, we can provide a more specific implication for design. Group recommenders calculate different kinds of compromises based on the tastes of the members in the group [5]. One of the main algorithms used is the least-misery algorithm, which does not merely calculate an average of the preferences of each viewer for the items considered, but avoids that one member in the group should watch something he or she really does not like—despite the fact that the average across the group would be the highest for all the considered items. How people make compromises on what to watch does not only depend upon the different tastes of the viewers. We have noticed that throughout the day, these compromises evolve. We have instances where an older child views a programme with a younger sibling merely because the younger sibling enjoys this. In this case, it is the younger child who determined what was watched. In the "family quality time" situation after supper, the focus is on being together and having a good time with the whole family. Also in these situations, the parents do not force their viewing preferences on the whole family. It is not that the children get to decide something they only like, but there is more attention to their preferences in this compromise. After "family quality time", the parents usually get to see what they would like. This information could help to alter the way compromises are calculated in the different situations by also incorporating time of day in addition to characteristics of the members in the group.

5.4 Implications for novel interface concepts

Existing user evaluations of recommender systems interfaces are carried out on more traditional concepts such as a grid of items and the provision of feedback via ratings. These concepts do not adapt to specific viewing situations. As Churchill pointed out, we do not only need to focus on how to calculate a better set of items, but also think about how we can improve the interaction and engagement with the system in different situations [4]. Novel user interface concepts explore how the amount of content items, the types of content, the look and feel, and the provided functionality could be customized for each different situation. Let us consider the viewing situations "family quality time". During the first viewing situation, the whole family is present. We can assume that there are many different preferences at this time because many different members of the household are present. Therefore, it would

be better to offer more content items than less. Our results also indicate that mainly lighter genres should be considered at this time. There should be sufficient functionality to quickly ask for other recommendations when the current recommended set does not provide an acceptable set for every member. For the situation "weekend mornings", the provided interaction should be basic since younger children are watching, the look and feel should be playful (as is explored in [27]), and the offered content should only include programmes for children, musical programmes, and funny content. For "when the children are sleeping", one or more parents really want to be engaged with a suitable item. The offered items should include mainly longer form content and content that demands more attention. Furthermore, since the viewing is dedicated sufficient information about the available shows should help the parents make the right decision. After all, compared to "family quality time" where the family is more engaged with each other than with the content, parents really want to enjoy this moment and avoid having to switch to another programme 15 min into the show.

5.5 Limitations

Firstly, we would like to address the methodologies used in both studies. The second study involved seven households and did not include singles; the data used in the workshop were based on only 4 days of diary entries. Given the qualitative nature of our study, we do not believe that only involving seven households forms a major issue, certainly given the research aim. Our goal was not to perform an exhaustive search towards all possible viewing situations; our goal was to look at typical viewing situations and learn more about how the contextual elements unfold and determine the viewing situation. Because we only involved families with children for Study 2, the respective results are less representative for singles or couples, for example. However, the situations that occur in households are likely to be the most complex ones. Therefore, one could consider a subset of the current viewing situations for other types of households. For singles and couples, there would not be "weekend mornings" and "family quality time". It is more likely that other viewing situations that are realistic for couples and singles are spread over time. Since "family quality time" does not exist for couples, the contextual aspects of "when the children are sleeping" would probably be applicable earlier. Confirming these hypotheses should be subject of future research. Secondly, we note that only one father was present during the workshop sessions. This means that the point of view of the father was not incorporated directly in the exercise of the participating households to create the viewing situations in the clusters. However, the diary entries included the information on every member of the household, sometimes also people outside the household such as friends. Therefore, we argue that the perspectives of the fathers are mostly included; this is indicated by the references made by the families to the fathers' viewing activities on the post-its and during their presentation of the clusters at the end of the workshop. Finally, there is another methodological difference between the two studies. The interviews in Study 1 were conducted after a three-week diary period, whereas workshop in Study 2 was only based on a four-day-long diary period. The results in Study 1 are therefore closer to the actual behaviour, while Study 2 better reflects how people make sense of these experiences. The latter aspect is equally important seen the recent developments in user experience methodologies that focus on retrospective gathering of user experiences [26]. Nevertheless, since the diary in Study 2 covered only 4 days, and the workshop was organized 2 days after this period, the actual events were not too distant in the participants' memories.

6 Conclusion

This article reports on two studies that were conducted to better understand how video and television programmes are viewed in the home. The results allow us to design recommender systems and interfaces that better fit the actual viewing experiences in the home. Therefore, a first study was conducted to gain better understanding of the contextual aspects that determine TV and video viewing situations in the home. The results illustrate how the household structure determines the viewing situations, the importance of the amount of attention paid to different types of content, the relation between the type of content and the viewing behaviour—planned, routine, or spontaneous, and the different ways in which people discover new content. The second study identified typical viewing situations in households of families with children, and the contextual aspects that comprise these situations. After combining the insights from both studies, we identified the seven viewing situations: weekend mornings, when the children are sleeping, family quality time, relaxing after school, a free moment, men and sports, and lazy afternoons. For each situation, we determined the manifestations of the following contextual aspects: mood, content, viewers, time, content delivery time, and viewing mode. Our contribution is that more contextual aspects were considered and more manifestations of these aspects were included in order to identify the viewing situations in the home compared to the state of the art. The results allow us to design recommender systems that offer items that better fit each viewing situation and novel interface concepts that better support the viewers in each situation. For future

work, we have started implementing a recommender system based on our results in the Netherlands for an on-demand platform of the Dutch public broadcaster NPO. The latter is carried out in the TV-RING project; the related prototypes will be field-tested involving approximately 40 households in the first half of 2015.

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