System Supporting Self-Motivated Video-Viewing Stops for Children

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Abstract: The popularization of video-viewing systems enables both adults and children to continuously watch countless video clips. However, such extended video viewing might cause health problems, particularly for children. Rule-making tendencies are weaker for video-viewing systems than they are for television programming. Children struggle with self-motivated video-viewing stops because of attractive, rich clips. In this study, we propose a video recommendation system that arranges video clips based on a pre-set time, to support self-motivated video-viewing stops. Our proposed system enables parents to limit video-viewing time in advance and provides video clips that are arranged to finish exactly at a pre-set time. We conducted two experiments. The first experiment targeted adults to confirm the effectiveness of our approach. Our results from the first experiment suggest that our proposed system creates a good video-viewing ending time and could support self-motivated video-viewing stops. Our second experiment targeted children and aimed to obtain children’s reactions to the use of our developed system, as well as feedback from their parents. We observed the children’s self-motivated video-viewing stops. In addition, we obtained good impressions of the system from parents.

Key Words: video recommendation, childcare support, voluntary stop.

1. Introduction

Parents have begun to use smartphones as childcare support devices. For example, parents often give their smartphones to children as video viewers, which even toddlers can control to watch YouTube [1] video clips by themselves. In fact, in Japan (as of March 2014) the diffusion rate of smartphones among adults in their 20s was 83.7% [2]. Young adults also spend more time on the internet than watching television [3]. Children can easily use smartphones and play with smartphones instead of toys.

However, giving smartphones to children is creating several childcare issues. Eyesight might be harmed by sustained smartphone use, which is a serious problem for both parents and children. Even if parents set rules to prevent sustained use, such rules are more weakly applied to smartphone use than television watching [3]. Japanese mothers are relatively reluctant to intervene in the television-watching habits of their children [4]. The number of children using smartphones is also rapidly increasing. It is difficult to assume that children will voluntarily curb their smartphone use. The unlimited contents provided by smartphones are too enticing for children. Such video contents are generally used by children with smartphones [3].

Why can children not stop video-viewing punctually? One significant reason is well-designed and implemented video recommendation systems. In research fields, many video recommendation systems have been studied. Xu et al. [5] proposed a personalized recommendation algorithm for online content, including videos and predicted user interest based on attention times to online contents. Attention time was measured using eye-tracking. Deng et al. [6] proposed a personalized video recommendation system based on cross-platform user modeling. YouTube, the most well-known video-sharing website [1], recommends personalized sets of video clips to users based on their activity on the site [7]. These recommendation systems improve recommendation accuracy and provide many suitable videos to users. Such recommendation systems endlessly recommend attractive video clips to children, making self-motivated video-viewing stops difficult for them. Video viewing system for children also have already been developed. Google developed YouTube Kids [8], a mobile application for children. Although YouTube Kids has a function for limiting video-viewing time, the function forcibly terminates video-viewing by stopping displaying video clips, and does not try to encourage self-motivated video-viewing stops. Some researchers have focused on video-viewing time limits. Casio [9], which is a microwave oven with a liquid crystal display (LCD) display that enables people to watch videos while they are waiting for the oven to finish cooking, automatically delivers media content for idle time. Although they focused on time limitations for video-viewing, they did not focus on video-viewing ending times. We focused on both video ending times and self-motivated video-viewing stops for children.

In this study, we propose a video recommendation method that supports children’s self-motivated video-viewing stops by creating a good ending time for video-viewing. To confirm the effectiveness of the end-time-creation method, we developed a system to fulfill the following three requirements and conducted experiments. First, we provided uninterrupted viewing for children. For example, our system engages children’s attention while their parents are busy with housework and unable to give attention to their children. Second, children should stop viewing at a pre-set time. Children have difficulty turning off
smartphones, and parents often fail to set rules to prevent sustained use. Therefore, our system encourages children to stop watching video clips. Third, children must be satisfied. Although it is also possible to mandatorily stop video-viewing, we disagree with such a method.

2. Self-Motivated Video-Viewing Stop Support

To develop a system that supports children stopping video-viewing punctually based on a time duration pre-set by their parents, we consider the perspectives of both children and their parents.

From the perspective of children, we consider two points. The first is self-motivated video-viewing stops. As mentioned in the introduction, we believe that one factor explaining why children cannot stop video-viewing is the existence of well-designed recommendation systems, whose endless recommendations are designed to encourage more video-viewing. Such endless recommendations prevent children from stopping video-viewing voluntarily. Therefore, the system needs to provide a good ending time for video-viewing. The second is satisfaction with the ending time for video-viewing. If we take away video-viewing devices from children while they were watching videos, children might stop watching videos; however, such an approach would not encourage voluntary stops and children would not be satisfied.

From the perspective of parents, they would hope for children to be focused on video-viewing until the pre-set time, but also hope that children would stop viewing videos after reaching the pre-set time. Sometimes, parents are busy with housework et al. and are not able to pay attention to their children. In such a case, the system should engage children’s attention for a pre-set duration, after which the parents are free. As mentioned in the introduction, because of various health issues, parents are concerned with preventing extended video-viewing by their children. Recently, the overuse of smartphones and smartphone addiction have become social problems [10]–[12]. Smartphone addiction is a problem not only for adults but also for pre-school-aged children [13]. Considering this type of social problem, we believe it is important for childcare support to help children stop video-viewing punctually at the parental pre-defined time, rather than to engage children’s attention to videos for as long as possible.

Based on these considerations, we developed a video recommendation system with a video playlist that ended when the pre-set time came.

3. System Architecture

Figure 1 shows the architecture of our system, which uses the YouTube’s application programming interface (API) to show videos to children. The system consists of a controller for parents and a viewer for children. First, the controller sends requests to the viewer to make playlists based on input keywords and time durations controlled by parents. Second, based on such information, the viewer searches for appropriate video candidates by accessing YouTube. Finally, the viewer makes an appropriate playlist, which includes videos based on keywords (Fig. 2). The controller and viewer are directly connected to one another (i.e., we use a peer-to-peer approach). Moreover, we use hypertext markup language (HTML) and JavaScript to build a platform-independent system. The parents control the playlist properties through the system, which has functions for controlling volume and searching for candidate videos through YouTube’s API using keywords and time durations.

The procedure for making a playlist is summarized in Fig. 3. The system creates a playlist using videos shorter than 4 min, because the system aims to engage children’s attention for short durations (5 min to 30 min) while their parents cannot attend to them. If the system were to use long videos (for example, a 20-min video), the video would take up a large portion of the playlist and cause decreases in that playlist’s time accuracy. Note that the length of a video playlist and candidate videos can be changed according to necessity. In this paper, the length of candidate videos is selected as 4 min based on the considerations described above.

Because the system shows a snapshot image of the video being played on the controller, parents can stop the video if its content is inappropriate. The system displays the duration and the playback status of the playlist in the controller. Parents can determine the remaining playback time and decide when the playback will end. For this purpose, the system stores the current playback time and playlist ending time. Figure 4 shows a snapshot of our system.
The system also has a function that dynamically remakes the playlist if network delays or video interruptions occur, by storing the current playback and ending time (Fig. 5). If such stoppages occur and the ending time of the playback exceeds the input time duration of the playlist, the system remakes the part of the playlist that was played-back after the interruption, and compares the playback ending time and playlist input time duration when each video playback is almost finished. If the ending time of the playback exceeds the input time duration of the playlist, the system remakes it and restarts its playback. Because users cannot detect such remaking, they can continue to enjoy seamless playlist playback. Additionally, the ending time of the playback does not exceed the pre-set ending time.

4. Experiments and Results

Our system targets young children, who have difficulty answering experimental questionnaires. Therefore, to confirm the effectiveness of our approach, we conducted two experiments. Experiment 1 targeted adults and aimed to confirm whether our developed system provided a good video-viewing ending time. Experiment 2 targeted children and aimed to obtain children’s reactions to the use of our developed system, as well as feedback from their parents.

4.1 Experiment 1

4.1.1 Participants

In total, 22 college students (eight women and fourteen men, who averaged 20 years old, \( SD = 0.70 \)) participated in the experiment.

4.1.2 Conditions

We used a within-participant experiment design to evaluate and compare with/without video recommendations based on the pre-defined time durations of video viewing with the following two conditions:

**Proposed:** In this condition, participants viewed a video playlist made by our proposed system based on a pre-set video-viewing time duration. Video playlist playback ended when the pre-set ending time came.

**Alternative:** In this condition, participants viewed a video playlist made by our proposed system without considering a pre-set video viewing time duration. The system randomly chose videos without considering the pre-set time duration and made a playlist based on input keywords. Video playlists under this condition did not end at a pre-set ending time. In most cases, the video playlists’ playback was in progress at the preset video-viewing ending time.

4.1.3 Procedure

First, participants were given a brief description of our experiment as follows: “you use two video recommendation systems and view recommended videos from each system until the pre-set video viewing time duration comes.” Because this experiment had a within-participant design, each participant viewed two video playlists made by the two conditions. The order of conditions was counterbalanced. The participants filled out a questionnaire after video-viewing each condition. We defined the time duration of video-viewing as 10 min, because our system aimed to engage children’s attention while their parents could not attend to them (during times when parents were busy with housework, etc.) and because we did not intend to use long videos in our video content. Video search keywords were freely input by participants.

4.1.4 Measurement

In experiment 1, we measured a subjective item by questionnaire: appropriateness of video-viewing ending time. The questionnaire item was evaluated on a 1-to-7-point scale (7 being the most positive). We also prepared a free description form.

4.1.5 Results of Experiment 1

Figure 6 shows the questionnaire item results. The mean value of the proposed condition is 5.45 (\( SD = 1.79 \)). The mean value of the alternative condition is 4.18 (\( SD = 1.74 \)). To analyze these results, we conducted a paired t-test. We identified a significant difference among the conditions (\( t(21) = -2.499, p = 0.021, d = 0.72 \)), which indicates that participants were satisfied with the video-viewing ending time.
We gathered free description feedback that contained favorable remarks about the video-viewing ending time for the proposed system, including “the ending time of the video-viewing was good,” and “the ending time felt neither too quick nor too slow.” We also gathered eleven negative comments for the proposed system. All of these comments were about the video content recommended by the system. These negative comments were divided into the following three categories: (1) poor relationships between the input search keywords and displayed videos, (2) similarity of the displayed videos, and (3) other. Details for each category are described as follows. First, seven of the negative comments were about the poor relationships between the input search keywords and the displayed videos. For example, “recommended videos were not what I expected to watch,” and “I did not understand the criteria for video recommendation.” Second, two negative comments were about the similarity of the displayed videos: “similar videos were recommended more than once,” and “it is not good that similar videos are displayed.” Third, there were two other negative comments: “I wanted to play series animations in order,” and “I wanted to select what I would watch.”

4.2 Experiment 2

4.2.1 Participants

Sixteen young children ranging from 3 to 6 years old and their parents participated in the experiment.

4.2.2 Environment

Figure 7 shows the experimental environment. The room was approximately 40 m². Toys, books, and chairs were available in the room for participants to play with and/or sit on. We placed a PC along the wall on a table to allow children to view videos. A child sat on the floor or stood near the PC and could watch videos.

4.2.3 Condition

Experiment 2 was not a comparative experiment. Therefore, the experiment had only one condition: a child watched a video playlist made by our developed system.

4.2.4 Procedure

First, participants were provided with a brief description of our experiment (10 min). Second, parents were provided with an explanation of how to use the system. After this explanation, the parents freely input search keywords (5 min) and the children viewed videos (10 min). After video-viewing, the parents filled out questionnaires (approximately 10 min). We defined the time duration of video-viewing as 10 min for the same reason as in experiment 1.

4.2.5 Measurement

In experiment 2, to confirm the effectiveness of our system for children, we measured subjective items using the following questions:

1. It is better to limit the time children can watch videos than to let them watch videos endlessly. (Video-viewing based on pre-set time)
2. Children would be satisfied enough even with this system. (Satisfaction of children)
3. It is better to show videos to children with this system than to let them watch videos freely. (Usefulness of the system)

The questionnaire items were evaluated on a 1-to-7-point scale (7 being the most positive). We also prepared a free description form.

4.2.6 Results of Experiment 2

Figure 8 shows the results for questionnaire items. The mean values of the items are 6.44 (SD = 0.964), 5.63 (SD = 0.957) and 5.38 (SD = 1.20) respectively. The values of the results refer to average values, because experiment 2 is not a comparative experiment.

We gathered free description feedback that contained favorable remarks about system functions, including “I was relieved because I could know the videos the child was viewing,” and “My child dislikes stopping video-viewing while videos are playing, so the system is good.”

5. Discussion

5.1 Implications

5.1.1 Experiment 1

We experimentally verified the effectiveness of our proposed system that encourages video-viewing stops. It received favorable feedback with respect to the playback ending time: “the playlist ended with nice timing” and “the ending time of the playback was good, because it was nicely timed as the video finished.” Participants seemed to have these feelings, because the proposed system made a playlist based on the input time duration, and its playback ended at a pre-set time. The alternative system condition received significant negative feedback: “I didn’t like being forced to stop viewing in the middle of a video” and “I wanted to see the rest of the video.” Participants seemed to have such feelings because they were informed of the end of video-viewing while they were watching the video. These results suggest that our proposed system creates a good...
ending time for video-viewing and could support self-motivated video-viewing stops.

5.1.2 Experiment 2

In experiment 2, we observed behaviors that expressed self-motivated video-viewing stops when the pre-set time arrived and the playlist ended. Children’s behavior at the stopping point was divided into the following categories. 6.25% of the children talked to their parents when the pre-set time arrived and the playlist ended. 6.25% of the children tried to close the PC and began playing with other things in the room. The remaining 87.5% of children started playing with other things in the room at once. We think that these results suggest the proposed system could facilitate a good ending time for video-viewing for children and support self-motivated video-viewing stops.

5.2 Negative Feedback on the Proposed System

As mentioned in Section 4.1.5, we received negative feedback regarding the proposed system. First, we received negative feedback regarding the poor relationship between the input search keywords and the displayed videos. Two main causes might explain this problem. First, there were not enough suitable videos for the input search keywords on YouTube. Video durations often depend on keywords, and if the time durations of many videos relevant to the keywords exceed the set times for playlists, the candidate videos will not include enough appropriate videos. If there are insufficient relevant videos, YouTube includes poorly related videos in the search results. The system also includes playlist results and displays videos that are unrelated to participant demands. To prevent this problem, we must consider using not only keywords but also categories that provide broader information about user demands while the system makes playlists. The system also uses too many candidate videos to make a playlist. Candidate videos are ranked in the top 100 YouTube search results, and low-ranked videos are often poorly related to keywords. As a result, depending on keywords, playlists sometimes have too few relevant videos. To prevent this problem, the system must decrease the number of candidate videos for making playlists. If it decreases the number of candidate videos, playlists are more likely to have many relevant videos. If the number of candidate videos is insufficient, a playlist is more likely to have many relevant videos, but the temporal accuracy of the created playlists decreases. It is difficult for machines to achieve a good balance between increasing playlist satisfaction level and achieving temporal accuracy.

In addition, we received negative feedback about the similarity of the displayed videos. Our system does not include identical videos in a playlist and does not evaluate such content. Although some children will repeatedly watch the same video, the viewing motivation of adults might decrease. Future work will consider video content when making playlists.

5.3 Children’s Behavior during the Experiment

In experiment 2, except during video-viewing, children behaved freely in the environment shown in Fig. 7. When parents began playing videos, children basically watched videos continuously. The children’s behavior during the video-viewing time can be described as follows. 62.5% of the children moved from the front of the PC during video-viewing to take toys. However, they returned at once and continued to watch videos before the pre-set time arrived. 37.5% of the children kept quiet and watched videos before the pre-set time arrived. While some children moved from the front of PC, they returned at once. Basically, children kept quiet and watched videos once video-viewing started before the pre-set time came. These results suggest that the proposed system created a video playlist that could attract children’s attention.

5.4 Limitations

In the experiment, we used 10 min as the pre-defined time duration, and the system created a playlist consisting of videos that were shorter than 4 min in length. However, the system can set a time duration with no limitations according to necessity. This is because in the proposed system, we assume that parents will select a time duration on their own initiative and/or parents and children will discuss and decide the time duration. If the pre-defined time is longer than 10 min, the system may also need to modify the maximum length of candidate videos to be longer. The relationship between pre-defined time and maximum video length would affect the quality of videos included in the video playlist. This is because if the system makes a video playlist with only short videos when the pre-defined time is long, the video playlist would include many videos with low relevance.

5.5 Future Work

Future work will investigate the effects of video durations and number of videos contained in a playlist on children’s satisfaction. In our experiments, because the system randomly selects videos and makes playlists based on a pre-set time, no effects of video durations and numbers were revealed. Moreover, using the video-viewing history of each child to control playlists might be useful for find appropriate videos. By gathering and analyzing these data, our system could produce improved playlists. Related to this topic, sensing children’s emotions and behavior might be useful for personalizing video services. If children are strongly interested in specific videos, the system might recognize those videos and modify future playlists.

Another goal for future work is to investigate the potential social acceptance of our system. Shiomi et al. reported that the social acceptance of childcare support systems using sensing or robotics technologies is lower than popular childcare support technologies such as anesthesia during labor. However, they also reported that the experience of actually using new technologies increased the social acceptance of those technologies [14]. We believe that the social acceptance of our proposed system will be relatively low during its initial application but that actual experiences with using the technology will increase social acceptance. In this context, long-term field trials in real situations such as home environments would be important for investigating both the changes in social acceptance and the effectiveness of the proposed system. Such a field trial would be useful for investigating how the proposed system will support parents (i.e., even if the proposed system only saves a few minutes, it will be useful in busy situations).

6. Conclusion

We proposed a video recommendation method that supported self-motivated video-viewing stops by children, by creating a
good ending time for video-viewing. We developed the system to make a video playlist end at a pre-set time. Our system, which consists of a controller for parents and a viewer for children, makes and plays an appropriate playlist, based on keywords and time durations input by parents. Unlike traditional recommendations for video-viewing systems, our proposed system arranges video clips based on a pre-set time to support self-motivated video-viewing stops.

In this paper, we experimentally targeted adults and identified a significant difference between the proposed and the alternative conditions, in terms of the appropriateness of the video-viewing ending time. In the experiments targeting children and their parents, we observed children making self-motivated viewing stops. These results indicate that our proposed system creates a good ending time for video-viewing and could support self-motivated video-viewing stops. Although our experiments for children were not comparative, our research can have an impact, because it proposes a video recommendation method that satisfies both childcare support and smartphone addiction prevention.

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