

Coco's Videos: An Empirical Investigation of Video-Player Design Features and Children's Media Use

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ABSTRACT

In this study, we present Coco's Videos, a video-viewing platform for preschoolers designed to support them in learning to self-manage their media consumption. We report results from a three-week experimental deployment in 24 homes in which preschoolers used three different versions of the platform: one that is neutral to the limits they set, one that enforces the limits they set, and one that attempts to erode the limits they set by automatically playing additional content after the planned content is finished ("post-play"). We found that post-play significantly reduced children's autonomy and likelihood of self-regulation, extended video-viewing time, and led to increases in parent intervention. We found that the lock-out mechanism did not reduce video-viewing time or the likelihood of parent intervention. Together, our results suggest that avoiding platforms that work to undermine the user's intentions is more likely to help children self-regulate their media use than rigid parental controls.

Author Keywords

Children, media use, interaction design & children, parental mediation, preschoolers, child-computer interaction, parental controls, auto-play, post-play.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous;

INTRODUCTION

Entertainment media plays a central role in the lives of young children, with the average preschooler watching more than three hours of television, film, and other video programming each day [10,31]. Children's television and videos can provide productive learning opportunities for kids [15] and useful respites from caregiving for adults [24], in addition to serving as an enjoyable part of daily life. However, child development research also suggests families set limits on the

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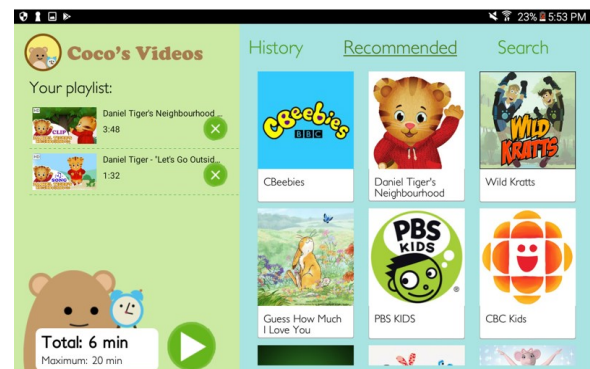


Figure 1: The playlist-building screen: Coco's Videos supports planning out a playlist of videos to watch. Here, playlist items accumulate on the left as they are selected. On the right, the user can choose between one of three tabs. Here, the "Recommended" tab is selected, and recommended channels are shown. The user can drill down into any channel to select individual videos.

amount of time preschoolers spend consuming passive video content, as heavy viewing has been linked to increased risk of obesity [26], reductions in imaginative play [8], and sleep disruption [14]. In addition, the low cognitive demand and high-reward experience of viewing videos make it easy for viewers to engage in extended consumption [11].

In this study, we examine the role of design as it relates to children's transitions to and from video viewing experiences. As part of this, we investigated two different existing design paradigms with the potential to influence children's transition behaviors. First, a variety of commercial products known as "parental controls" offer to support parents in setting and enforcing limits on children's use of technology, including controls specifically targeting video viewing [41]. Second, in direct contrast to the limit-enforcing goals of parental controls, many popular platforms serving videos include post-play features and next-video suggestions that seek to promote continued viewing and minimize natural stopping points by automatically playing new content when the selected video ends. Prior work has shown that parents find post-play and related features frustrating and believe these impede their family's ability to set boundaries [24].

The extent to which either limit-enforcing (parental controls) or limit-eroding (post-play) designs influence families' behaviors in practice is not robustly understood. Prior work suggests that the authoritarian design and rigidity of parental

controls are unlikely to best serve families' needs [30,32,41], while other work has shown that these interfaces are often poorly understood and difficult to use [21,29]. To the best of our knowledge, no prior work has examined the effect post-play in the context of limit-setting, despite the fact that it is a common feature of Internet video-on-demand platforms such as Netflix and YouTube.

We undertook the current project in pursuit of two specific goals. The first was to build on our past design work [22] to create a video-viewing platform to support preschoolers in planning their media consumption with intention. The second was to conduct an experimental study to understand how designs intended to either enforce or erode families' limits influence parents' and children's experiences with this system in a real-world context. To do this, we created "Coco's Videos," which we deployed in the homes of 24 families with preschoolers for three weeks. We conducted a within-subjects comparison of families' responses to three different versions of the system. In these conditions, the platform alternatively: 1) remained agnostic to families' limits, 2) actively attempted to enforce families' limits with a lock-out mechanism, or 3) actively attempted to undermine families' limits with a post-play mechanism.

We found, first, that children engaged with the core experience with intention and displayed autonomous decision-making as they planned their video viewing. In addition, children took ownership of their transition experience as they ended their viewing and moved on to other activities. Second, we found that post-play extended children's viewing time, led to increased intervention from parents, reduced evidence of children's autonomy, and was perceived negatively by parents relative to the other versions of the system. Third, we found that the lock-out mechanism did not appear to reduce children's autonomy, although it also did not reduce viewing time or increase the need for parents to intervene.

As media corporations increasingly seek to engage and monetize the attention of their preschool audience [7], it is useful for the design community to understand how specific design choices influence children's patterns of engagement and disengagement. While children's media plays a positive role in daily life for many, families' usage patterns will always necessarily include both disconnecting and connecting. The contribution of this work is to support designers in understanding how their choices may influence children's ability to autonomously self-regulate their use of media and parents' self-efficacy in supporting their children's media habits.

RELATED WORK

Preschoolers, Media Use, and Media Effects

Media use in early childhood has been the subject of extensive scholarship. Prior work has shown that most children use devices as infants and toddlers, including 97% of children under the age of four [27]. For many children, media use is a routine part of daily life, with the average preschooler spending approximately three hours with technology every

day [10,31,47]. Although modern technology offers a wide variety of digital activities ranging from video chat to virtual reality, watching videos is preschoolers' most common digital pastime [24,47].

A large body of work in child development has examined the effects of media use on children's wellbeing, linking extensive fast-paced video content to attention disorders [12,42] and violent media exposure to increases in hostility and the perception of hostility in others [17,40]. Other work has explored the potential of television and other media to support positive growth, including learning, creativity, and prosocial behavior. These studies have shown, for example, that video can enable social and emotional learning [34] as well as skill development and school-readiness [15,36], especially when coupled with parent support.

Risk, Fear, and Parental Controls

Children's eager adoption of technology has inspired some social concern and a number of public campaigns to limit children's exposure to digital media [6,9,33,43]. Although the large amount of time children spend with technology calls for examinations of ways in which technology use influences children's long-term wellbeing [38], it is useful to note that these questions are asked within a cultural frame of reference that foregrounds risk to children [25], and in doing so, may overlook opportunity costs and create new burdens for families. Given this context, it is unsurprising that a recent review of existing parental controls reports that these tools have a risk-averse orientation and focus exclusively on restricting and controlling children's behavior [41]. As a result, other work in HCI has called for a re-imagining of the design of parental controls [32] to move beyond restricting children and toward mentoring children in developing healthy and productive media habits.

In that spirit, recent design research in HCI has explored interfaces to support parents and children in selecting and filtering content collaboratively [20] and working together to plan the ways in which they will use apps and games [22]. Other work has investigated designing for parents and children to use digital media together [5,39]. An ethnography of families' technology practices suggests that this supportive approach may be more useful for families than traditional parental controls. The authors found that families' boundaries are fluid and unlikely to be best-served by tools that assume pre-defined and deterministic limits [30].

We built on this past work by first conducting design research to understand families' responses to tools for promoting intentionality and autonomy rather than compliance. To help further our understanding of the effectiveness of parental controls, we also examine the result of adding a lock-out mechanism to this experience.

Supporting Children's Autonomy

By the time children turn three, they have the emergent ability to plan, set goals, and choose their own actions with intention [13]. Evidence-based preschool curricula support

children in developing these skills [3,37], and experts in education and child development recommend that preschoolers regularly have the opportunity to plan how they will spend their time and receive feedback about the behaviors they enact relative to their self-defined plans. By doing so, children strengthen their ability to make purposeful choices and their ability to self-regulate their behavior [13].

Similarly, self-determination theory explains that children's ability to self-regulate requires intrinsic motivation to enact specific behaviors and internalization of norms [19]. Understanding social expectations and values and then having the opportunity to autonomously choose to enact these norms enables children to exercise executive function, control impulses, and adopt the expectations of their community. In contrast, controlling children and demanding compliance works to undermine their sense of autonomy and ability to self-regulate [28], suggesting that parental controls may in fact diminish children's self-control with respect to media use. We build on this existing work by designing a system intended to foreground children's choice-making and prompt them to set goals, rather than restricting their behavior.

SYSTEM DESIGN

Design Process

This work was informed by a series of interviews with 27 parents of preschoolers and a diary study with another 28 families exploring their experiences ending their time with entertainment media and transitioning back to the physical world. As part of these interviews, parents reviewed a set of storyboards of design ideas for transition support. Storyboards included designs in which the technology the child was using "got tired" and told the child it needed to go to sleep, a paired system that allowed the parent to make changes to a child's tablet settings through a separate phone, timers, and other features. We evolved these storyboards as we conducted additional interviews to incorporate participants' feedback.

We also conducted a participatory design workshop with seven preschoolers in our target age range [23] and a lab study of a related system to examine how children think about their tablet use and how they respond to nudges from the system [22]. Our final design incorporated insights from all three of these design projects. We expand on our prior work in the lab [22] by creating a new system that focuses on video consumption (rather than apps or games), deploying this system in the wild (rather than evaluating it in the lab), and, exploring the system in relation to post-play and parental controls.

Coco's Videos

The result of this design work was an app for Android devices that we called "Coco's Videos." Coco's Videos allows the user to build and play a playlist of videos, drawing content from YouTube via the YouTube API. Upon opening the app, the only interactive content is a "play" button to begin the experience. Pressing this button takes the user to a screen

with a clock (Figure 2, left) where a cartoon character named Coco asks, "*Hi there! How much time should we spend watching videos?*"

A "next" button allows the user to move past this time limit screen and displays a set of nine possible "next activities" from which the user can select (Figure 2, middle). As these are presented, Coco says, "*When you're done watching videos, what will you do next?*" The categories of activities, such as "*Read a book,*" "*Play outside,*" and "*Leave the house*" were generated by clustering next-activities that children engaged in after using technology as reported in 381 diary entries we collected as part of a separate project on children's media use. We also included "*Something else!*" as a flexible catch-all for activities that might not fit our categorizations. The user can select any one category, switching as many times as needed. As soon as a category is selected, a "next" button becomes visible in the bottom right corner of the screen.

Pressing "next" from this screen takes the user to a video-selection screen (Figure 1) where Coco says, "*Ok! Now let's pick some videos.*" A pane on the right side of the screen displays three different tabs, each of which can be used to find content:

- **History:** The default tab is the history tab, which displays the most-recently viewed videos as thumbnails with titles and durations listed in reverse chronological order of viewing. If the app has never been used to watch videos, no content is displayed.
- **Recommended:** Using ratings from Common Sense Media [44], we selected twelve different YouTube channels with particularly high-quality content designed for our target age range, including CBeebies, Daniel Tiger's Neighborhood, PBS Kids, and CBC Kids. Our recommendations tab displays each of these channels in a grid as a thumbnail and title (Figure 1). Tapping any one of these channels displays a grid of its videos.
- **Search:** The search tab displays a text box with a microphone icon and a magnifying glass, giving the user ability to search by typing or by speaking (we enabled text searching with the assumption that only parents would use this feature and expected children only to use voice search). Searching uses YouTube's API to return the top 21 most-relevant search items, displayed as thumbnails in a grid with titles and durations. A user can load indefinitely many additional results (in batches of 21) as needed.

Tapping a video thumbnail in any of these tabs adds the video to a persistent playlist on the left side of the screen. Once added, any video can also be removed. Only videos whose duration fits within the remaining budget of the total time limit can be added, and as the total duration of the playlist grows, ineligible videos are grayed out and disabled. If a user taps a disabled thumbnail, Coco says, "*We don't have enough time for that one!*" Pressing a "play" button at the bottom of the playlist transitions to a full-screen video player

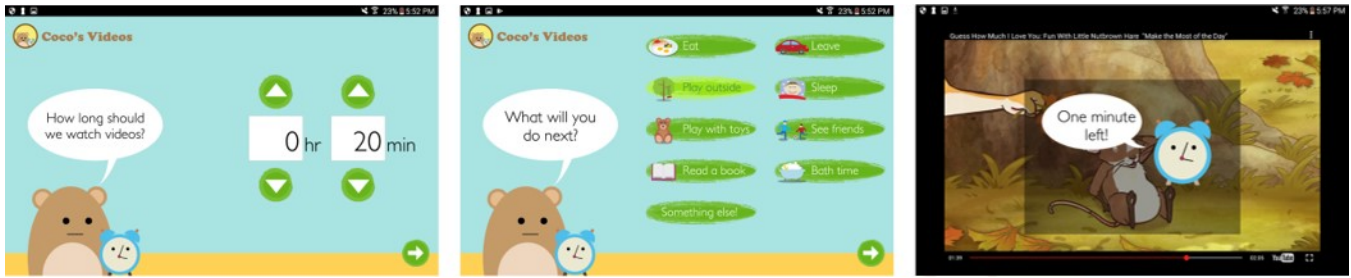


Figure 2: Screenshots for creating and watching a playlist. Left: The first screen of the experience allows parent and child to choose the duration of the experience. Middle: Selecting the activity that will follow, such as reading a book, going outside or taking a bath. Right: The video player. One minute before the playlist ends, a warning notifies the user of the upcoming transition.

which plays through each video in the playlist in the order specified by the user.

If there is more than one video in the playlist, at the start of the last video, the video content pauses and an overlay is added above the content that displays an alarm clock and a message. Audio plays: “*We’re almost done! Get ready to say goodbye when this video ends.*” Tapping anywhere on the screen dismisses this warning and resumes playing the video, but the video never restarts unless the screen is tapped. If this final video is more than one minute long, then one minute before it ends, the video pauses again and an overlay with an alarm clock is again displayed above the content (Figure 2, right). Audio plays, “*One minute left, then it’s time to say goodbye.*” Once again, the video does not resume until the user taps the screen.

When the playlist ends, a transition screen appears displaying text and an image that correspond to the next-activity the child selected when constructing the playlist (e.g., taking a bath, eating, or playing with toys). Coco says, “*Now it’s time to [next activity]. Are you ready to [next activity]?*” As described in the methods section, we created three variants of this transition screen to represent our three study conditions. The default version of the transition screen is shown in Figure 3, left.

METHODS

Participants

| | |
|-------------------------|--|
| Child Gender | Male (58%), Female (42%) |
| Child Age | Mean (sd) = 3.6 (0.92) years; Age 3 (N = 16), Age 4 (N = 5), Age 5 (N = 4) |
| Child Race | White (88%), Asian (4%), Mixed (8%) |
| Household income (US\$) | 25–50K (8%), 50–75K (4%), 75–100K (21%), 100–125K (21%), 125–150K (8%), 150K or more (38%) |
| Parent Education | High School (8%), Trade School (4%), Associate Degree (4%), Bachelor’s Degree (42%), Advanced Degree (42%) |
| Parent Marital Status | Partnership (8%), Married (92%) |

Table 1: Participant Demographics

Twenty-four families completed all procedures and were included in our final sample. These participants were recruited through an institutional participant pool drawn from regional birth records. All families had at least one child between the ages of 3 and 5 years old (inclusive) who was considered the target of the study. In addition to this age specification, a second inclusion criterion was that target children use screen media at least twice per week on average. Our data over-sampled white children and families with two married parents, and household income among participants was higher than the regional median of \$80,349 [1]. Participant demographics are shown in Table 1.

Procedures

We conducted an experimental study with a randomized complete block design, where each participant was treated as a block and experienced each of three experimental conditions. Parents from the participant pool who responded to a phone solicitation were directed to a screener survey, composed of questions about family demographics and the target child’s media use.

Families then received a Galaxy Tab E Android tablet by mail with a copy of Coco’s Videos pre-installed and configured. Families were asked to give the target child the opportunity to use Coco’s Videos at least five times per week, for at least five minutes each time, for a period of three weeks. They were told that they were welcome to use the app as much as they wished above and beyond that lower bound. As a thank-you for their participation, families kept the tablet at the conclusion of the study.

Over the course of the three-week study period, the app rotated between each of three different conditions: neutral, controlled, and post-play. The experience in each of these three conditions was identical, except for the elements displayed on the transition screen. That is, in all three conditions children set a time limit, chose a planned next activity, and constructed a playlist in the exact same way. The transition screen differed across the three conditions in the following ways:

- **Neutral:** In the neutral condition, a large “home” button was also displayed in the bottom right corner of the screen.

Pressing this button brought the child back to the beginning of the experience and enabled the child to create a new playlist (Figure 3, left).

- **Post-play:** Borrowing terminology from the Netflix feature [45], we created a “post-play” condition. Here, children saw the exact same screen as in the neutral condition (including the home button), and they also saw a small embedded video player in the top right corner. When the transition screen appeared, the app queried the YouTube API for recommendations based on the final video in the playlist that had just completed. These recommendations were then played serially in this small embedded player. The child could make the player full-screen or otherwise engage with the toolbar (e.g., to pause or advance the content) (Figure 3, middle).
- **Controlled:** In the controlled condition, children saw the exact same screen as in the neutral condition, except no home button was present. As no element of the screen was interactive, the user was locked out of the app once they reached this point. After a three-minute delay, the app would reset and return to the home screen automatically (Figure 3, right).

All participants saw all three of these versions of the app, each for a period of one week. The order of conditions was counterbalanced across participants, and between 3 and 5 families were assigned to each possible ordering. The ordering was hard-coded into the app by participant ID, and the app automatically displayed the condition-specific transition screen based on the ID and start date. Thus, the experience automatically changed slightly every seven days without any updates or notifications.

The app collected three types of data during the deployment:

- **App usage:** The app logged all of the user’s interactions and inputs, including the time limits they selected, the terms they searched for, the videos they chose, the amount of time they spent watching videos, and the timestamp when they pressed each button.

- **System usage:** The app also tracked usage across the device for a period of three minutes after a playlist ended, documenting which apps were used and for how long. We also logged when the tablet was turned off.
- **Audio capture:** Beginning one minute before each playlist ended, the tablet microphone began recording ambient audio data. This sample stretched from one minute before until two minutes after the transition. Audio recordings were stored in the cloud using Amazon Web Services S3 platform. In addition to discussing this audio sampling with each family during the consent process, we also displayed a red dot on the screen any time the app was recording audio (and informed them that they could look for this indicator). We also gave families the ability to delete any recording they did not want us to access, although no families chose to do this with any of their recordings. Audio capture persisted for three minutes as long as Coco’s Videos was running (e.g., even if the screen was turned off or the app was moved to the background).

After completing the experimental procedures, all participants were invited to complete a follow-up survey about their experience using Coco’s Videos. These were sent out in batches, and because of participants’ staggered start dates, parents received the survey between 2 weeks and 2 months after their study period ended. In the survey, we asked parents to report what they liked and disliked about the app, what their child liked and disliked, how they felt about the lock-out mechanism, how they felt about post-play, and whether they continued using the app after the study ended, among other questions. Twenty parents completed the survey and one parent completed the first half.

Data Analysis

Quantitative analysis: We used our app-usage and system-usage logs to construct a dataset of distinct playlists watched by each child. For each playlist, we first noted whether or not the child actually saw the transition screen (e.g., if the child exited early, he or she did not have engage in the designed transition experience). Only playlists that ended with one of

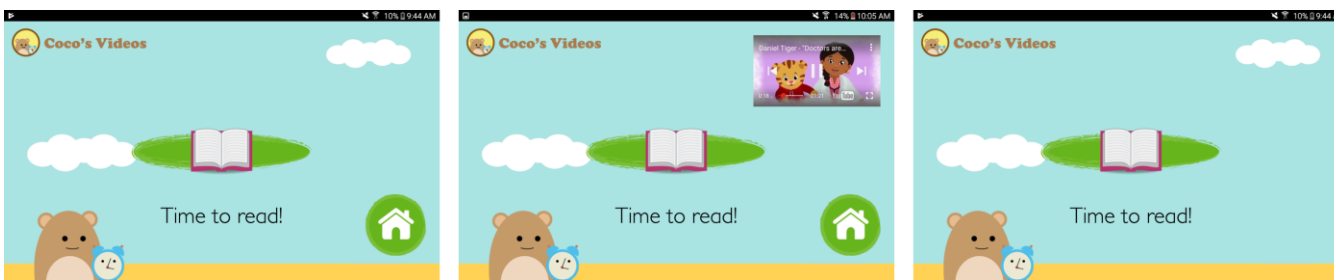


Figure 3: Transition screen experiences. Left: Neutral experience where child has the option to press to press the home button (bottom) right. Middle: Post-play experience where child has the option to press the home button and create a new playlist (bottom right) and videos related to the most recently viewed video play automatically (top right). Right: Controlled experience where no home button is displayed and no content on the screen is responsive. In all three conditions, the activity the child selected as his or her next activity when constructing the playlist is reflected on screen (here, reading). In all three conditions, when the screen is displayed, Coco says, “Now it’s time to read. Are you ready to read?”

the three types of transition experiences (post-play, neutral, and controlled) were included in our analysis ($N = 411$).

Qualitative analysis: The system captured 3-minute audio recordings for the transition period surrounding 332 playlists. In 33 of these instances, the child ended the session after the warning but before the transition screen appeared, and in 7 instances, the audio was not clear enough to analyze. Thus, our audio-clip dataset was composed of the remaining 292. To analyze audio clips, two researchers first listened to each clip individually and transcribed each one. We then divided the clips across the research team and performed an individual open coding to identify potential themes, which were discussed as a group and evolved into axial codes based on similarities across researchers. Examples of final codes included whether the child responded to the Coco character, whether the parent intervened to stop the child from watching additional content, whether the child and parent agreed to change the planned transition, and whether the child made statements about his or her autonomy when transitioning. One researcher coded all 292 audio clips based on this coding scheme; a second researcher coded a randomly selected 10% to assess interrater reliability. Cohen's κ was .783.

RESULTS

Children's Usage Patterns

Over the course of three weeks, participants collectively created 597 different playlists using Coco's Videos, an average of 24.88 playlists per child ($SD = 9.25$). The average playlist lasted 18.44 minutes ($SD = 21.00$) and contained 8.2 videos ($SD = 9.60$). Children chose to end the playlist early 31% of the time, often to adjust and restart the active list of videos. The amount of time children spent watching a single playlist ranged from less than 1 minute to exactly 2 hours.

Children frequently re-watched videos they had seen before. Collectively, children included 2,452 videos in their playlists, and 53% of these were selected from the "History" tab that displayed their 21 most-recently watched videos in reverse chronological order. This tab was also the one that was displayed by default. When children added new content, they were more likely to choose from our "Recommendations" library (Figure 1) than they were to search for content on their own. Of the 1,149 videos children selected that were *not* already in their recent history, 69% came from our recommendations library, while 31% were added by searching, suggesting that presenting default content selections could be an effective means of funneling children toward specific experiences.

Transition Timing

Using logged data from the device, we reconstructed the way in which the tablet was used when a playlist ended. As one measure of a child's response to a transition, we calculated the amount of time between when the playlist ended and when the active session ended, which included time spent watching post-play videos, time spent creating and watching new playlists, and time spent using other apps on the tablet.

We then compared this additional post-transition session time across the three conditions. Because data were non-normally distributed, we first performed a log transformation on post-transition session duration. We then used a block ANOVA to account for non-independence of samples, with condition (neutral, post-play, controlled) as the independent variable and participant ID as the blocking factor. This revealed a significant difference between groups in post-transition session duration ($F(23) = 4.204, p < .001, \eta^2 = .233$).

Post hoc analysis revealed that post-play sessions had significantly more spill-over time than neutral sessions (mean difference in logs = .189, 95% CI [.002, .377], $p = .047$) and significantly more spill-over time than controlled sessions (.322, 95% CI [.119, .525], $p < .001$). The difference between the neutral and controlled conditions was not significant (.1328, 95% CI [-.066, .331]). A Bonferroni correction was applied to all comparisons.

Engaging with Coco

Through our audio recordings, we documented that children were highly responsive to Coco's presence and frequently spoke directly to Coco and/or repeated Coco's words. Across all conditions, the transition screen (Figure 2) was always accompanied by audio asking the child about her next activity. For example, if a child indicated when creating the playlist that she would read a book when it ended, at the end of the experience Coco would say, "*Now it's time to read. Are you ready to read?*" Coco made this statement regardless of condition.

Children routinely replied to this question, speaking directly to Coco. For example, when Coco asked one child, "*Are you ready to eat?*" the child responded, "*Mm-hmm, I'm hungry!*" Other children replied to Coco's transition question saying things like, "*I'm ready to play outside,*" "*Yes!*" "*I'm going to get a snack,*" "*Of course [I'm ready],*" "*I'm ready to do something else,*" and "*Goodbye!*" In a minority of instances, children interacted with Coco by pushing back against the norms she presented. Occasionally, children replied to Coco's question by saying things like, "*No, I don't [want to],*" "*I'm not [ready],*" or "*No! Nope nope nope, no.*"

Our audio recordings also suggest that children came to expect this interaction with Coco as a routine part of transitioning. As one playlist approached its end, the child anticipated Coco's script and asked his mother, "*Is she gonna say, 'Time to say goodbye'?*" Another child resisted putting the tablet away before the transition audio played, saying, "*I want to see what she [Coco] says.*" Coco then said that it was time for bed and asked the child, "*Are you ready for bed?*" The child responded, "*Yeah,*" and then began preparing for bed.

A third child turned off the screen before the audio could finish playing, saying, "*I'm ready for lunch.*" He then quietly stated the words that would have played if he had let them: "*Are you ready to eat?*" suggesting that this audio was a predictable part of his routine. Another child responded to

Coco's question by saying that she could not eat dinner because her father had not yet come home from work. She explained to her mother, "I want to hear, 'It's time to eat' again...when Daddy gets home," the point when the meal could begin. In these and many other instances, children demonstrated that this dialog with Coco became a meaningful and expected part of transitioning.

Though children engaged with Coco and responded to the character directly in all three conditions, they were less likely to do so when post-play videos were displayed. During the transition, children spoke directly to Coco 16% of the time when post-play videos were displayed and 40% of the time when they were not. A chi-square test comparing the presence of this direct response (Y, N) across conditions (controlled, neutral, post-play) revealed that this difference was significant $\chi^2(2) = 16.75, p < .001$. Post-hoc analysis revealed that children were significantly less likely to speak directly to Coco in the post-play condition than in either the neutral ($Z = 2.81, p = .005$) or the controlled ($Z = 4.07, p < .001$) condition. There was no difference between the neutral and controlled conditions with respect to children's likelihood of responding directly to Coco. These results suggest that the competing content of post-play made it less likely that children attended to and participated in the designed transition experience.

Promoting Coco's Transition Norms

We saw that children frequently responded to the transition prompt by internalizing Coco's statements as norms and autonomously enacting—and even enforcing—transition expectations. In many cases, children promptly turned off the tablet without parent oversight in response to the transition screen. Children often explained aloud that they were moving on to the follow-up activity they had planned for themselves, and in our audio clips they can be heard saying things like, "Time to sleep," "It's time to eat, and I'm eating," or, "I'm ready to go outside...I clicked 'going outside' after my videos."

In one instance, a child responded to Coco's assertion that it was time to do "something else" by saying, "Now I'm not going to watch any more...I'm going to do something else." His mother replied, "Ok, time to do something else. What are you going to do?" The child replied that he wanted to dance and instructed his mother to "turn on music." He could then be heard singing and dancing in the background. Similarly, one mother joked with her child, saying, "What will you do next? Clean the living room? Is that what you want to do next?" to which the child replied flatly, "No, I picked play outside," highlighting her agency in selecting her next activity and referencing her in-app selection as the plan of record. Across these and many other examples, we saw that children took ownership of the transition and connected it with their own intentions and their self-defined plan.

In other instances, children went beyond adopting these norms for themselves and worked to set these same expectations for others. In response to Coco's question, "Are you

ready for bed?" one child announced to his family, "Everybody! It's time for bed!" Another child turned to his brother and repeated Coco's message, saying to him: "It's time to eat. Are you ready to eat?" A third child watched the playlist together with her father, and when the one-minute warning was displayed, explained to him, "we have one minute left," implying that the expectations applied to both of them. Children informed their parents of transition expectations, saying things like, "Dad, it's time to read," and "See what the tablet said?" Another child explained first to his mother and then his father, "We have to go now," imposing Coco's statement that it was time to leave the house on each of his parents.

We coded each audio clip for the presence of these autonomous statements of transition ownership. We observed that children were less likely to transition autonomously or state and promote these norms when post-play videos were displayed. A chi-square test comparing the frequency with which children transitioned autonomously (Y/N) across conditions (neutral, post-play, controlled) revealed that this difference was significant $\chi^2(2) = 14.655, p = .001$. Post hoc analysis revealed that children were less likely to display autonomy when post-play videos were shown than in either the neutral ($Z = -2.50, p = .012$) or the controlled ($Z = -3.85, p < .001$) condition. There was no difference between the neutral and controlled conditions in children's likelihood of displaying autonomy.

Finally, we saw that as children embraced these norms, they occasionally did so maladaptively. One child explained to his mother that after you select your next activity, Coco will "make you do it;" his mother then explained that the next-activity suggestions were not about policing behavior and were there to "give you an idea of what's next." Another child explained after finishing a playlist that he had to go back and do the entire experience over again from the beginning, because he had picked the wrong follow-up activity and now could not go to bed because Coco had not said, "Now it's time for bed." In these cases and a few others, children focused on rigidly adhering to Coco's stated expectations. These behaviors suggest that while children in this age group may eagerly adopt norms presented by the system, they may also have a strict interpretation that is more closely aligned with the tool's literal presentation than its broader goals.

Undermining Limits

While children often ended their session as planned, at other times they chose to undermine the limits they had set for themselves and continued watching videos. In response, parents sometimes enforced the planned transition, sometimes ignored (or perhaps were unaware of) the child's decision to continue watching, and sometimes expressed agreement that creating a new playlist fit their family's schedule and needs and supported their child in undermining the pre-existing plan. The frequency of each of these scenarios is shown in Figure 4.

When children chose to ignore their planned transition, parents' most common response was to intervene. In these instances, children watched post-play videos, returned to the home screen and created a new playlist, or even killed the app and restarted it to work around the lock-out mechanism. In our audio clips, parents can then be heard stepping in to stop the experience, and saying things like, "Is it over? Get your shoes," "Alright, that's it," "When the time comes up, you're supposed to hit the button and stop watching, ok?" "It's time to turn it off," and "C'mon, you were gonna eat. Wanna push this? I think you push this to turn it off."

However, in a non-trivial minority of cases, when children chose to ignore a planned transition, parents supported this decision and collaboratively revised the plan with the child, consistent with prior work on how families experience limit-setting [30]. For example, in one instance, Coco told the child, "Now it's time to eat," and the child's mother replied that it was not actually time to eat yet, because dinner would not be ready for another thirty minutes. The mother and child then agreed that the child should construct another playlist.

In another instance, Coco announced that it was time to read, and the child ignored this prompt and began making a new playlist. His father then said, "You want some help?" and the father and child then collaboratively built a new playlist together. Another time, one mother invited her child to ignore the planned transition, saying, "If you want to watch more videos, you can hit that button [home]." Though this was not parents' most common response, it occurred routinely enough to suggest that thinking of supports in this space as tools for enforcing strict and well-defined limits may not be the best reflection of families' needs and practices.

Responses to Post-Play

Parents expressed frustration with post-play both in-the-moment as their child used the system and in retrospect as they completed our post-study follow-up survey. When parents observed post-play videos during the study, they could be heard in audio clips saying things like, "It's time to play [with toys], but then they're playing another video," "I don't know why it gives us this extra video at the very end," and "What's *that* video in the corner? That's weird!"

Parents expressed negative feelings about our post-play experience in the post-study follow-up survey as well. We asked if parents preferred when these videos were shown, preferred when they were not shown, or had no preference; 71% said that they preferred when these videos were not shown, and 29% said that they had no preference. No parents reported that they preferred the presence post-play videos, suggesting that this common feature of commercially available video platforms is out of sync with some families' preferences.

We asked parents to explain this choice, and they told us that post-play makes transitioning more difficult by holding the child's attention with content he or she had not planned to

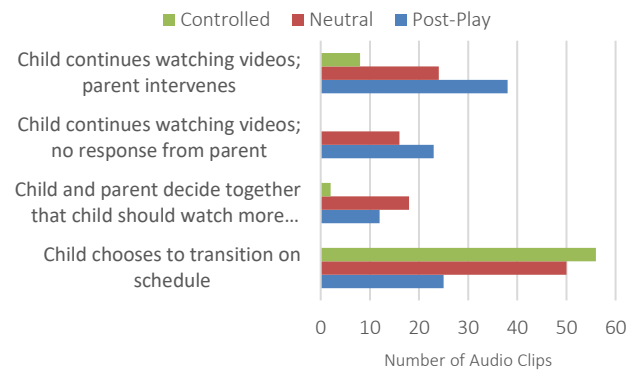


Figure 4: The way in which a session ended, by frequency

engage with. Parents called post-play "distracting," explained that it "undermined the 'time's up,'" and "made it hard to tell her that the videos were done." They felt that the post-play experience led to their child "being sucked in," "drastically increase[d] his resistance to stopping," and made it "more likely that my daughter would ask to keep watching." In addition to feeling that it eroded transitions, parents had a negative reaction to the fact that it gave the platform control of content choices, saying that, "I dislike the idea of random videos being shown to my child," and "my daughter likes to be in control of which videos she watches."

Responses to the Lock-Out Mechanism

In our follow-up survey, parents were divided in their reaction to the lock-out mechanism which prevented children from creating a new playlist once the transition screen appeared. More than half of parents appreciated this support saying, "this was great as it made sure screen time ended if we were not right there to take it away," and "it made cutting off watching time easier for me and him." However, 35% of parents disagreed, explaining that this was too restrictive and made it impossible for them to change their plans. These parents said things like, "if we both agreed that she could watch more, it would have been nice to allow it," and "sometimes I allowed him to continue depending on what I was doing and how well he behaved after his first session." For these parents, a pre-defined contract did not match their needs, as they value the ability to revise boundaries.

However, several parents who reported valuing hard-and-fast boundaries were also dissatisfied with the lock-out mechanism, because they felt it was not strict enough. These parents explained that an app-level control was insufficient saying, "he would exit the app and open YouTube directly" and that, "I would rather use the timer on my iPad which shuts the tablet off." Another parent explained that a feature to lock children out of technology is, "trying to solve a problem it can't solve," and explained that for her family, "it's not a useful feature without a global lock, which has its own set of problems."

Parents' Perspectives on Coco's Videos

Parents had a highly favorable response to the structure and goals of Coco's Videos, saying, "I loved that the app told her

it was time to stop and not me. It made transitioning easier,” calling it a “*great experience,*” and reporting that, “*I became more aware of what and how I was doing things.*” However, eight parents reported that the app would not fit their lifestyle in the long run, as the platform does not provide the content their child watches, and as a result, elected not to use it after the study ended.

Parents reported that they appreciated having built-in reminders for their child that the playlist was ending, saying things like, “*making him hit the button to continue after the last video warning seemed to really help as he for sure knew it was the last one,*” “*the warnings that the screen time was coming to an end was also a good feature that worked well for her,*” and “[*I*] liked that I didn't have to do any nagging or reminders about how many minutes of screen time were left.” Parents also repeatedly said that their children appreciated being able to choose their next activity.

Though we did not explicitly ask parents whether children displayed ownership over transitions or internalized norms, this was a consistent theme in responses to open-ended questions about children's reactions. Parents spontaneously reported that, “*I think it made him feel like a big boy,*” “*My child loved making choices,*” and explained that now they “*decide together...how long she'll watch before she starts.*” Nine of the 20 parents who completed the entire survey spontaneously reported that among the things they and their child liked best were ways in which the app gave the child choice, control, and ownership.

Eight parents reported that since the conclusion of the study, they had incorporated the app into their media routine and continued to use it regularly. Others said that they would like to do so, but that the content or the form factor did not fit their viewing habits, saying things like, “*if it integrated with our regular apps and [could] be the launcher like amazon kids unlimited we definitely would use it.*” Parents had a variety of suggestions for improvements that were unrelated to the transition structure, such as adding support for casting to a TV, integrating with Netflix, Nick Jr., and Amazon Video, changing the voice used for audio, and increasing the amount of content in the recommendations library. Nineteen of the 20 parents who completed the entire survey expressed interest in adopting the aspects of the system that supported planning video use and transitioning at the end of the experience.

DISCUSSION

Coco's Videos and Children's Autonomy

As children used Coco's Videos, they embraced the concept of planning and expressed ownership over the act of selecting their next activity. Parents reported that this was one of their child's favorite parts of the app experience. This thread of ownership carried forward to children's transitions away from the screen, and children often commented on their self-defined next-activity as they turned off the tablet. These demonstrations of intentionality are important, because prior

work has shown that planning and purposeful decision-making lead to gains in children's ability to self-regulate their behavior [37].

We saw that children not only enforced this transition for themselves, they also regularly extended transition expectations to those around them. Regulating others is an important part of the process of internalizing norms and learning to regulate one's own behavior [16], and our participants' acts of other-regulation are consistent with the process of adopting new goals for themselves.

However, we also observed that as part of its influence on children's behavior, the platform showed evidence of persuading some children to rigidly adhere to norms and treat the app as an authoritarian figure. Children's occasional insistence that they were required to comply with the app's commands, even when these no longer matched their own desires, was inconsistent with our goal of helping children identify and follow through on their own intentions. We plan to iterate on our design choices to investigate how we might evolve the transition screen to consistently surface the child's own authority. Future designs that incorporate voice recognition and enable the character to respond to the child would allow us to examine how an interactive experience influences children's attitudes or behaviors.

The Role of Post-Play

When Coco's Videos automatically played additional, related content after the playlist ended, children were less likely to verbalize statements of autonomy and less likely to engage in their planned transition, suggesting that this feature undermines the child's likelihood of self-regulating. Their tablet sessions were significantly longer, and parents were significantly more likely to step in and intervene, suggesting that the child and parent are more likely to be out of sync in the presence of this feature.

We saw that parents were frustrated by the presence of post-play and felt that it distracted their child, made expectations confusing, and made transitions more painful. Despite this consistently negative reaction, post-play is today a standard, default feature of many video-viewing platforms, including YouTube, Vimeo, Netflix, Hulu, Amazon Video, and even YouTube Kids. While this feature is sometimes presented as a convenience for the user with the intention of making it easier to find enjoyable content (e.g., [45,46]), our results show that in practice it works to erode families' planned behaviors and stands in direct contrast to users' desires. As prior work has shown that users sometimes abandon systems they feel are too addictive or too aggressive in demanding engagement [2], it is worth exploring whether features like post-play might discourage adoption in the long run.

The Role of the Lock-out Mechanism

Our child participants were equally autonomous and equally likely to disengage from video viewing with or without a lock-out mechanism. Our results show that for our participants, a neutral experience that reminds children of their own

intentions is as effective as strict controls that constrain their behavior. Drawing on self-determination theory [35], we expected that the lock-out mechanism would impede children's sense of autonomy and intrinsic motivation to adhere to transition norms. However, child participants were equally likely to make autonomous statements in the neutral and controlled conditions. This suggests that even if such controls are not necessary, it is possible that for young children they also are not problematic.

Parents had mixed reactions to the lock-out mechanism, with some valuing enforcement and others disliking the fact that the app took control. Parents explained that this feature made it harder for their family to nimbly adjust their planned media use, consistent with the many instances in which we observed families undermining and revising their own limits. Further, as prior work has shown that parents feel guilty about using technology to occupy their child [9,24,30], interface choices that promote strict boundaries, especially boundaries that parents may in fact decide to change, have the potential to unintentionally shame users for their choices while simultaneously failing to provide them with the experience that best fits their needs.

Design Implications

We see several ways that systems for preschoolers might consider the values and behaviors we observed in this study:

Design to support autonomy: We saw that children spoke directly to Coco, developed a parasocial relationship with the character, and answered Coco's questions even though the character was never interactive. Framing the transition as a question led children to reply aloud, announcing their intentions and reinforcing their autonomy. Our results suggest that designs that: 1) provide opportunities for planning and making choices, 2) remind children of their intentions, and 3) ask questions of the child, have the potential to promote autonomy and scaffold media self-regulation.

Support flexible limits and allow revision: Consistent with prior work [30], we saw that families do not always want to integrate media into daily life by setting pre-defined and consistent limits. While families valued the clear transition point we presented, they had a mixed experience with being locked into this plan. Controls that enforce limits not only fail to support the common user scenario of revising plans, they also deny children the opportunity to practice the important act of self-regulating.

Respect families' limits: While for-profit media corporations will always have an incentive to seek user engagement, disengagement will, by necessity, also be a part of media use. Designing for positive disengagement experiences has the potential to improve overall user satisfaction in the long run. Families' transition experiences were more prolonged and involved more friction when post-play was turned on. Our results suggest that avoiding post-play is more helpful in limiting children's media consumption than adopting a lock-out mechanism.

Limitations and Future Work

There are a number of limitations to the claims we can make from this data. We conducted this work with a small sample that was over-representative of middle-class and white families. This is a key limitation, as prior work has shown that controlling and "no nonsense" parenting strategies are useful adaptations in low-resource, high-stress environments and can foster children's self-regulation in these contexts [4]. Prior work also shows that controlling and authoritarian parenting styles operate differently in different populations [18]. We plan to conduct future work with more diverse families to develop a more complete understanding of the relationships among the design features we studied, parenting practices, demographics, children's self-regulation, and user satisfaction.

We also did not directly solicit feedback from children about their experiences, a perspective that would be a valuable complement to the data we present here. And although our three-week deployment gave us access to many usage instances for each family, it was too short for us to develop a robust understanding of participants' long-term habits in response to these features. Finally, given our design choices, we were limited to the content available on YouTube, which did not comprehensively include all of the content our participants typically engage with. Future work remains to investigate these design choices in the context of children's existing media routines.

CONCLUSION

Today's preschoolers will come of age in a world of constantly connected devices that will provide them with the opportunity to plug in at almost any moment. For these children, defining how they want to engage with this media ecosystem and managing their ongoing media consumption is likely to forever be a part of daily life. In this study, we present one possible alternative to today's parental controls, in which we move away from the traditionally authoritarian designs of this space. Our results show that through design, we can support children in becoming autonomous users. Or, through features like post-play, we can undermine their ability to self-regulate.

Child participants consistently showed evidence of wanting to take ownership of their transitions, and they demonstrated agency in both engaging and disengaging with technology. We conclude that the design community does not need to create tools to police excessive media use—we simply need to stop designing experiences to encourage it.

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