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Article

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Abstract
When parents select apps for young children (3–7), they have particular needs. However, it is unclear how these needs might be fulfilled. Uses and gratifications theory predicts that specific features of apps can fulfill needs, but empirical evidence regarding the types of features that fulfill these needs is nonexistent. To address this gap, a multimethodological design was used. Qualitative interviews (*n* = 20) revealed 23 features in children's apps that parents believe are important. A subsequent survey (*n* = 591) showed that parents want apps with (a) clear design; (b) tailorable, controllable, educational content; (c) challenges and rewards; and (d) technological innovation. Consistent with theory, analyses revealed that parents' needs relate to these app features, but child's age and gender play a key role in this relationship.

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The digital revolution has brought forth smartphones and touch screen tablets, and with this, has fundamentally changed our experience with media. This change is striking both in speed and size. Consider the growth of apps (software for touch screen technology)—within less than 10 years, the Apple App Store has grown from an initial 500 apps to more than 2 million available apps in the store today. This impressive growth is matched by equally impressive use rates. Today, the average smartphone or tablet owner spends 2 hours and 15 minutes per day using apps (American data, similar estimates worldwide; App Annie, 2017), the equivalent of 1 month per year. And while notable on its own, when we look at the youngest of society, estimates are particularly striking. For example, American research indicates that, as of 2017, nearly all children under the age of 8 live in a household with mobile media, a rate that tripled between 2013 and 2017 (Rideout, 2017) and that is expected to continue rising; with similar estimates found in industrialized countries worldwide (Cristia & Seidl, 2015; Findhal, 2012; Marsh et al., 2015)

While today's children are relatively competent users of touch screen media at a very young age, parents remain the facilitators, teachers, and gatekeepers of young children's media selection (Nikken & Schols, 2015; Padilla-Walker, Coyne, Fraser, Dyer, & Yorgason, 2012) and use (Chiong & Shuler, 2010). Not only do they influence how children experience apps (facilitators, teachers), but importantly, they play a prominent role in determining the types of apps that their children use (gatekeepers). As uses and gratifications (U&G) theory posits, people tend to select media as a function of their psychological needs (Katz, Blumler, & Gurevitch, 1973; Rubin, 2009). Indeed, when parents select apps for their young children, they are typically looking to fulfill one or more of their own needs (referred to as parent-centered needs) as well as the perceived needs of their child (referred to as child-centered needs; Broekman, Piotrowski, Beentjes, & Valkenburg, 2016).

Although these parental needs highlight what parents want in apps for their child and can provide useful starting points for designing apps, they do not necessarily reflect the specific features of apps that parents are looking for. The fundamental assumption underlying U&G is that the consumer (in this case, the parent) selects media (in this case, apps) based on the anticipated gratifications (parental need fulfillment) from the product (Katz et al., 1973; Rubin, 2009). These anticipated gratifications are thought to emerge as a result of certain features in the media content (Olson & Reynolds, 2001). For example, a parent might select a Dora the Explorer app because s/he wants their child to be entertained (parental need) and believes the character Dora (feature) can fulfill this need. In other words, needs and features work in tandem and yet, while we know a significant amount about the types of needs parents have when it comes to children's apps, we know considerably less about how these needs translate to specific app features. Moreover, it is unclear whether this need–feature relationship is the same for all children or, as is more likely the case, whether it varies by individual child differences. Consequently, it is difficult for researchers and media creators to understand how to efficiently integrate particular features in apps in order to sufficiently fulfill parents' needs. Through the lens of U&G, we aim to better understand how particular features of apps can fulfill parental needs associated with these apps.

Driven by this gap in the literature, this study is designed to address four interrelated aims. Specifically, the current study aims to (a) identify features in apps that parents

recognize when selecting apps for their children, and following this, (b) investigate which of these features are considered most important by parents. Next, guided by U&G theory, we (c) investigate how app features might fulfill parents' needs when they select apps for children. Lastly, as research indicates that age and sex differences play a role across many aspects of children's tablet use (Plowman, 2015), we (d) investigate the potential roles of these variables as both predictors and moderators of the needs–features relationship. In answering these questions, this study offers insights into parents' app selection process and provides guidelines that media creators can use when designing apps for young children.

App features

Features are described in many different ways for traditional as well as new media (Fisch, 2004; Goodrich, Pempek, & Calvert, 2009; McQueen, Cress, & Tothy, 2012; Valkenburg & Vroone, 2004). In children's media products, *content features* and *formal features*—audiovisual production features that structure, mark, and represent content—are among the most commonly discussed (Goodrich et al., 2009; Valkenburg & Vroone, 2004). Content features include such things as letters or numbers, foods and candies, and instructional speech (Valkenburg & Vroone, 2004). Formal features can be either perceptually salient or nonsalient. Perceptually salient features include features such as rapid pace (i.e., frequent scene and character changes), fast action, frequent camera cuts, sound effects, character vocalizations, visual special effects, and prominent foreground music (Goodrich et al., 2009). Nonsalient features, on the other hand, include dialogue, narration, slow pace, low action, and background music (Goodrich et al., 2009). Numerous studies, primarily with analogue media (most notably, television), have shown how these features influence children's attention, comprehension, and device usability (ease of use; e.g., Calvert, 2008; Kucirkova, Messer, Sheehy, & Fernández Panadero, 2014; Plowman, 2015; Valkenburg & Vroone, 2004). While not yet thoroughly investigated among digital media, it is reasonable to expect that formal and content features are both present in children's apps and may work in similar ways to influence attention, comprehension, and usability. Moreover, it is equally reasonable to assume that—due to the inherent interactivity of children's apps—apps may include more formal features than passive media (e.g., television), particularly formal features which support such interactivity by providing choices through which the user is able to control and change an action or outcome.

Interestingly, features are not only a key aspect of the app design process (Kiili, de Freitas, Arnab, & Lainema, 2012), but they are commonly used to describe, organize, and market children's apps in the Apple App Store or Google Play Store. Indeed, it seems that both formal and content features have come to serve as a heuristic aid that parents use when deciding whether a particular app may fulfill their needs. Of course, one can imagine that not all features are equally important to parents during app selection for their children. Parents may, for example, be less likely to think about the audiovisual aspects of the app (formal features) than they are to think about the content itself (content features). This is where understanding the needs of the user (the child), through a process known as child-centered app design, comes into play.

Child-centered app design

Though most (traditional) media products are designed on rather implicit assumptions and trial and error (Reiher & Acuff, 2008), today's app creators develop interactive technology using an approach in line with U&G known as user-centered design (Revelle, 2013). With user-centered design, the design of apps is not based solely on the capabilities of the technology, but rather on the needs of its prospective users (Revelle, 2013). In practice, one common way of implementing a user-centered approach is by incorporating the target group in the design process. In this aptly named *participatory design*, media creators discuss, demonstrate, and test content with their target group to ensure their needs are fulfilled through the incorporated features. Although participatory design has benefits for some target groups, incorporating children in the design process can be challenging since children, especially young children, are not always able to express their media needs (Nesset & Large, 2004). This does not necessarily mean that children cannot be incorporated in the design process—they can and should be incorporated, particularly for app usability. For example, the highly successful children's app company Sago Sago uses "playtesters" (children testing their app) as a crucial stage in the app-building process. But, while such testing can provide developers insight into the success (or lack thereof) of specific app features, it can miss some of the needs of the target audience.

One way to mitigate this challenge is by incorporating the voice of parents. In particular, involving parents in the design process can help developers identify the features that might fulfill the needs of both, parents (i.e., the gatekeepers of youngsters' media use; parent-centered parental needs) and the child user (i.e., child-centered parental needs). Although the literature highlights potential features that can facilitate a positive experience with apps, presently, it is not clear which app features parents identify in apps for children (RQ1), nor is it clear what the relative importance of these features is (RQ2). Such an understanding offers a first step towards incorporating the parental voice in the process of children's app design. Therefore, we ask:

> RQ1: Which features do parents identify in apps for their young children?
>
> RQ2: Which features are most important to parents when selecting apps for their children?

Understanding the features that parents believe are important in children's apps is only part of parents' app selection process. In order to maximize the likelihood of parents selecting particular apps, it is crucial that these features map onto the expressed needs of parents. Research has shown that parents have specific needs when it comes to selecting apps for their child (Broekman et al., 2016). First, and most prominent, they desire apps that are entertaining but at the same time foster independent play (need for independent entertainment). Second, they desire apps that encourage learning with content that they, as the parent, can control (need for coeducation). Third, they want apps that offer content that is familiar to their child (need for familiarity). Fourth, parents look for apps that present tailored content as well as content that is challenging to their child (need for a tailored challenge). Lastly, they look for apps that can occupy their children so they have time for other things (need for pastime). Although U&G suggests that media needs can

be fulfilled via media features, it remains unclear which needs are associated with the app features that parents identified as important. Thus, we ask:

RQ3: How are parental needs associated with parent-identified app features?

Lastly, it is important to recognize that the development of psychological media needs is an individual process (Rubin, 2009). It is not surprising then, that media needs are not universal. Many studies have shown that media needs vary by individual characteristics (Broekman et al., 2016; Rubin, 2009). For example, parenting style, one of the most important characteristics of parents, is associated with the extent to which parents express certain needs in apps for their child (Broekman et al., 2016). Specifically, parents who employ an authoritative parenting style, characterized by warmth and involvement, want their child to have an enjoyable self-guided experience to support their child's autonomy, but at the same time, believe that this experience will be healthiest when they can play a role in structuring the educational messages and when the content best fits their child's unique needs. On the other hand, parents who engage primarily in either authoritarian or permissive parenting seem more likely to look for apps that can serve as an electronic babysitter.

Just as media needs vary by the parent's characteristics, it is likely that the relationship between these needs and the perceived importance of app features varies by child characteristics, since the child is the actual user of the app. While there are many relevant individual differences that are worth considering, the literature suggests that the child's age and sex are particularly powerful characteristics that influence both, the selection and experience of media content (Plowman, 2015; Sherry, Lucas, Greenberg, & Holmstrom, 2013). Not only might parents consider their child's age and sex when establishing specific needs, but the extent to which features fulfill these needs may also depend on these characteristics. Understanding the potential predictive and moderating role of these characteristics, in terms of the needs that parents express as well as in the ways in which features may fit these needs, will provide insight into the importance of the child's characteristics in the parents' app selection process. Therefore, we ask:

RQ4: To what extent is child age (a) a predictor of parental needs and (b) a moderator of the relationship between parental needs and app features?

RQ5: To what extent is child sex (a) a predictor of parental needs and (b) a moderator of the relationship between parental needs and app features?

Method

Procedure

After receiving ethical approval from the sponsoring institution, a mixed-methods approach (qualitative interviews, quantitative survey) was used to address the research questions guiding this study. First, in order to address RQ1 (i.e., the features that parents identify in children's apps), a series of in-depth interviews were conducted with parents of children ages 3 to 7 using a style of interviewing known as laddering. Laddering interviews are generally used to understand choice criteria (Reynolds & Gutman, 1988). This

interview technique is used to understand features of selected products and the perceived consequences attached to these features (parental needs). In this study, probing "why" questions took the parents "up the ladder" from apps they considered to be good for their child to concrete app features they identified in these apps. More specifically, in the interview, the researcher asked the parents which apps their child used, if the parents thought these were "good" apps, and if so, *why* they thought the apps were good. These questions led parents to identify a range of app features that they felt were important for their child.

At the completion of the interviews, study authors analyzed all interview data. As is typical with laddering interviews, a list of app features was distilled from the interviews. These discrete features were then translated into statements designed to assess their importance (see Measures section). These statements, along with an assessment of parental needs and demographic variables, formed an online survey which was then conducted with parents of children aged 3 to 7 in order to identify which features are most important to parents (RQ2), how parents' needs are associated with app features (RQ3), and the role of children's age and sex (RQ4) in this process.

Participants

The in-depth interviews were conducted with 20 Dutch parents of children 3 to 7 years old (49.4% parents of boys; 17 mothers and three fathers) who were recruited on weekdays from several primary schools. The researcher (lead author) invited parents to participate in an approximately 1-hour in-depth interview. On agreement, parents made an appointment with the researcher. The interviews took place at the parent's home. After the interview, parents were compensated with a small gift for their children (stickers or pencils).

The survey data were collected by a large research institute in the Netherlands (GfK). This data collection was part of a larger project from which other data have been published elsewhere (Broekman et al., 2016). Parents were recruited through GfK's existing online panel (approximately 50,000 households) that is representative of the Netherlands. Parents were compensated €1.50 per completed survey for their participation. A total of 591 parents who matched the requirements for this study (e.g., had at least one child between 3 and 7 years; had a smartphone/tablet used by at least one of those children) completed the survey (M_{age} = 38.70 years, SD_{age} = 5.63). As a result of these selection criteria, the parents in the recruited sample were not nationally distributed in a way that is representative of Dutch parents. Among these parents, 41.6% were fathers and 58.4% mothers. Overall, 17.1% of these parents had one child, 54.3% had two children, and 28.6% had three or more children. In the survey, parents answered questions with one child in mind (randomly selected within the survey). Of these children, 50.3% were boys (M_{age} = 5.40 years, SD_{age} = 1.34).

Measures

App features. Since there is no existing scale that measures the importance of app features, data from the in-depth interviews were used to create this researcher-developed

assessment. In all, the in-depth interviews resulted in 23 app features that were translated into 32 discrete statements for use in the online survey. This mismatch between number of app features and number of statements resulted from the need to clarify some participant comments. For example, the structure of the app was found to be important during the interviews. However, in the interviews, parents noted the importance of app structure in terms of both storyline and inclusion of levels. As such, the original feature distilled from the interview ("app structure") was more clearly and accurately delineated into two items (". . . an app that has levels" and ". . . an app that has a storyline"). In the online survey, parents were asked to indicate the level of importance they attached to 32 app features in an app for their child. Statements were, for example, "(almost) everything in an app reacts when the screen is touched" and "there are different possibilities within an app (i.e., puzzles, drawings, stories, videos, games)." Answer categories ranged from 1 (*not at all important*) to 5 (*very important*).

Parental needs. Parental needs were measured in the online survey using 25 needs items that reflect parent- and child-centered needs for apps (Broekman et al., 2016). Statements were, for example, "I want my child to learn something in an app" and "My child wants to be rewarded in an app." For each statement, parents were asked to indicate the extent to which they found the statement important when selecting an app for their child on a scale from 1 (*not at all important*) to 5 (*very important*). Following typical conventions for needs measurement, these discrete items were factor analyzed and resulted in five parental needs: *need for independent entertainment* (six items; $M = 4.20$, $SD = .47$, $\alpha = .86$); *need for coeducation* (four items; $M = 3.71$, $SD = .55$, $\alpha = .70$); *need for familiarity* (four items; $M = 3.37$, $SD = .50$, $\alpha = .69$); *need for tailored challenge* (eight items; $M = 3.61$, $SD = .50$, $\alpha = .82$); and *need to pass time* (three items; $M = 2.92$, $SD = .66$, $\alpha = .63$).

Child characteristics. The child's sex and age (date of birth) were assessed in the online survey.

Covariate: Parenting style. Parenting style was measured using 20 items adapted from the Parenting Styles and Dimension Questionnaire (Robinson et al., 1996). These adapted items have been used successfully in other research (Piotrowski, Lapierre, & Linebarger, 2013). For each item, parents were asked how often they exhibit particular behaviors towards their child (i.e., "I encourage my child to talk about [his/her] troubles" and "I find it difficult to discipline my child") on a Likert scale from 1 (*almost never*) to 5 (*very often*). Because parenting styles are not mutually exclusive (Robinson et al., 1996), a mean score was calculated for each parent on each of the three parenting styles. This means that the same parent might have high authoritative scores, high authoritarian, and moderate permissive scores, depending on their self-reported parenting behaviors. Three parenting style scales were constructed: authoritative parenting, characterized by warmth and involvement (seven items, $M = 4.26$, $SD = 0.46$, $\alpha = .85$); authoritarian parenting, characterized by nonreasoning and punitive strategies (six items; $M = 1.88$, $SD = 0.56$, $\alpha = .75$); and permissive parenting, characterized by lack of follow-through (seven items; $M = 2.46$, $SD = 0.56$, $\alpha = .74$). This variable was used as a covariate where appropriate (see Analytic Approach section).

Covariate: Parental education. Parents indicated their highest level of education with seven options ranging from no education to a doctoral degree or beyond. To facilitate analyses, data were recoded to reflect low (6.3% reflecting none to preparatory secondary education), moderate (38.1% higher secondary education), and high levels of education (55.7% reflecting university and beyond). Higher scores indicate greater education ($M = 2.49$, $SD = .61$). This variable was used as a covariate where appropriate (see Analytic Approach section).

Analytic approach

To address the study research questions, several analytic approaches were employed. First, to address RQ1 (the types of features that parents identify in apps for their young children), a descriptive analysis of the qualitative interview data was conducted (see Table 1).

Following this, to address RQ2 (the importance of the features), the survey data were analyzed. While the item-level data do reflect app features that are more or less important to parents, we expected shared variance between many of these items, thus reflecting more general categories of features. To obtain these more general categories, factor analysis was desirable. Upon examining the data, it was determined that traditional exploratory factor analytic approaches (i.e., Kaiser rule) were inappropriate due to the item-level skewness. An alternative approach that is less sensitive to such skewness—namely, parallel analysis—was therefore employed. Parallel analysis is a robust approach to identifying stable factors and is appropriate for nonnormally distributed ordinal variables (Basto & Pereira, 2012). In these analyses, items with factor loadings lower than .40 were omitted as well as cross-loading items (items that have a factor loading of .40 or higher on one or more factors). A total of five items were removed. Tables 2 and 3 provide information relevant to these analyses.

RQ3 asked whether the needs which parents express when it comes to apps for their young children are associated with app features that parents deem important for children's apps. As correlations between the five measured parental needs and the identified individual features would lead to concerns about Type 1 error, multiple regression models were conducted predicting each identified app-feature category instead. As such, the five measured parental needs served as independent variables and the app-feature categories (identified in RQ2) served as dependent variables. All models controlled for parental characteristics (parenting style, sex, and education) as research has shown that these characteristics can potentially impact parents' needs and preferences in media choices for their child (Broekman et al., 2016; Plowman, 2015). Table 4 provides a complete accounting of these models.

Lastly, RQ4 and RQ5 asked to what extent child characteristics (age, sex) may predict parental needs or moderate the relationship between parental needs and app features. In order to investigate RQ4 and RQ5, the PROCESS macro in SPSS V. 21 was used (Preacher & Hayes, 2008). Each included child age or child sex as independent variable, all parental needs as mediating variables, and one app-feature category as dependent variable. As with the multiple regression models in RQ3, all models controlled for parental characteristics (parenting style, sex, and education). To address issues of normality, all estimates were bootstrapped (1,000 samples). Table 5 provides a complete accounting of these analyses.

Table 1. App features identified in the in-depth interviews.

App features	Definition
Feedback	The app is highly responsive, (almost) everything the child touches has a response.
Child friendly design	The app has a plain, simple, and mostly visual design, with moving objects and friendly characters.
Variety	The app offers different possibilities (puzzle, drawing, story, video, game) as well as different activities within these possibilities.
Familiarity	The app includes shapes, characters, or actions that are recognizable to the child.
Easy	It is clear what to do with the app.
Challenge	The app offers a task that has a certain difficulty to complete.
Learning	The app presents a school-like learning objective (letters, numbers). The app offers content that provides knowledge of life (emotions, motor skills, spatial awareness).
Technology	Innovative techniques are used in the app (multitouch, sliding, extension of toys).
Tailoring	The app content matches the skills and knowledge of the child.
Structure	The app is arranged by different levels, parts, or through a storyline.
Support	In the app, help is provided visually or through sound.
Sound	The app includes sound (background music, response to actions).
Pace	The app has no fast-moving, flashy imagery but is presented at a moderate pace.
Fun	The app has something entertaining or funny in it.
Rewards	After completion of a task there has to be a reward (coins, sound, speech, upgrade).
New content	The app offers new levels, characters, tasks (after completion of a level or task).
Coplay	It is possible to play the app with multiple persons (same or separate devices).
Child customization	The child has the opportunity to set his/her own preferences in the app (character, colors, etc.).
Gaming	The app includes a competitive activity for amusement that can be played according to rules.
Walled garden	The app has a preselected child-friendly demarcation, so the child can move freely within the app.
Parental settings	The parent has the opportunity to set his/her preferences in the app (sound) and find information about the app (intention, developers).
Creation	The app offers the opportunity to create (draw, create own story).
Imagination	The app offers actions that are impossible for children to do in real life.

Results

App features (RQ1)

Overall, in the in-depth interviews, parents identified 23 unique app features ranging from features that focus primarily on content (e.g., variety, familiarity, fun) to formal features (e.g., feedback, rewards, coplay). There were some clear preferences for formal

Table 2. Parallel analysis with varimax rotation on the importance that parents attach to app features.

App feature items	M (SD)	TCL	UoT	CD	CaR
I, as a parent, can find information about an app, such as the intention or information about the developers.	3.64 (.87)	**.70**	.19	.04	.01
The content of an app is tailored to age, which means the child is automatically set to boundaries on what he/she is exposed to.	4.05 (.76)	**.66**	.08	.13	−.11
I, as a parent, can set preferences in an app, such as sound settings.	3.80 (.86)	**.65**	.13	.14	.06
The app presents a school-like learning objective, such as letters and numbers.	3.97 (.75)	**.63**	.03	.16	−.19
An app teaches my child social skills (such as how to interact with other children).	3.72 (.82)	**.62**	.14	.07	−.24
An app has no fast-moving, flashy imagery but is presented at a moderate pace.	4.04 (.59)	**.53**	.04	.28	−.02
An app lets my child create something, such as a drawing or making their own story.	3.70 (.73)	**.53**	.25	.16	−.18
An app includes shapes, characters, or actions that are familiar to my child.	3.54 (.85)	**.42**	.33	.39	.02
An app produces sound as a response to touch.	2.53 (.90)	.08	**.80**	.11	.01
An app includes background music.	2.53 (.89)	.04	**.79**	.12	−.07
In an app my child can do things that are impossible for him/her to do in real life.	2.89 (.85)	.00	**.56**	−.02	−.15
An app includes a storyline.	3.30 (.78)	.24	**.53**	.16	−.25
It is possible to coplay in an app, which means my child can use an app with multiple persons (same or separate devices).	3.13 (.93)	.26	**.49**	−.16	−.27
An app offers modern technology such as multitouch (touch multiple things at the same time) or sliding.	3.16 (.95)	.24	**.49**	−.00	−.23
The design of an app is clear.	4.15 (.54)	.28	−.15	**.74**	−.17
The design of an app is colorful.	3.86 (.68)	.17	.15	**.74**	−.08
The design of an app is simple.	3.76 (.79)	.15	.04	**.70**	.13
The design of an app has moving objects.	3.77 (.72)	−.05	.33	**.67**	−.20
The design of an app has friendly characters.	4.12 (.68)	.37	−.04	**.65**	−.20
In an app it is clear for my child what he/she has to do.	4.14 (.58)	.28	−.24	**.56**	−.33
An app offers new content, such as new levels, characters, or tasks.	3.69 (.79)	.09	.28	.09	**−.77**
An app has levels.	3.43 (.87)	−.02	.35	.02	**−.72**
After completion of a task there has to be a reward such as coins, sound, speech, or an upgrade of some kind.	3.66 (.87)	.01	.32	.13	**−.67**
An app includes a challenge, which means it offers a task that has a certain difficulty to complete.	3.95 (.65)	.37	−.10	.01	**−.59**
An app has something entertaining or funny in it.	4.11 (.63)	.21	.05	.38	**−.52**
My child can set his/her own preferences in an app (such as choose a character, a color, or a car to use in an app).	3.64 (.82)	.18	.36	.11	**−.52**
In an app my child can play a game.	3.81 (.61)	.26	.17	.34	**−.42**

Note. Factor loadings > .40 are in boldface. Omitted items (cross-loading or < .40) are removed from table.
TCL = tailored controlled learning, UoT = use of technology, CD = clear design, CaR = challenge and reward.

Table 3. Correlation matrix (spearman rho) for app features.

App feature	TCL	UoT	CD	CaR
Tailored controlled learning	1.0	.35	.47	.42
Use of technology		1.0	.25	.43
Clear design			1.0	.35
Challenge and reward				1.0

Note. All correlations are significant at $p < .05$. TCL = tailored controlled learning, UoT = use of technology, CD = clear design, CaR = challenge and reward.

Table 4. Multiple regression analysis of app features, parental needs, and parental characteristics.

	Tailored, controlled learning			Use of technology			Clear design			Challenge and reward		
	B	SE B	β	B	SE B	β	B	SE B	β	B	SE B	β
Need for independent entertainment	−.03	.03	−.03	−.18	.05	−.14**	.21	.04	.23***	.11	.04	.10*
Need for coeducation	.32	.03	.40***	.13	.04	.12**	.06	.03	.08*	.01	.03	.02
Need for familiarity	.19	.03	.24***	.16	.04	.15***	.18	.03	.23***	.12	.03	.13***
Need for tailored challenge	.18	.03	.21***	.47	.05	.40***	.12	.04	.13**	.42	.04	.43***
Need to pass time	.01	.02	.01	.11	.03	.13**	.02	.03	.03	−.03	.03	−.03
Authoritative	.13	.04	.13***	−.07	.05	−.06	.11	.04	.11**	.14	.04	.13**
Authoritarian	−.02	.03	−.03	.03	.05	.03	−.02	.04	−.03	−.02	.04	−.02
Permissive	−.00	.03	−.00	.03	.04	.03	−.00	.03	−.00	.02	.03	.02
Parental sex	.03	.03	.03	−.04	.04	−.04	.11	.03	.12**	.03	.03	.03
Parental education	−.04	.01	−.12***	−.04	.02	−.08*	−.02	.01	−.07*	−.03	.01	−.08*
Child sex	.06	.03	.07*	−.07	.04	−.06	.04	.03	.05	−.08	.03	−.08*
Child age	−.00	.01	−.01	.05	.02	.11**	−.03	.01	−.09*	.09	.01	.25***
R^2	.49			.33			.35			.42		
F	46.54***			23.16***			25.45***			35.50***		

Note. $*p < .05$. $**p < .01$. $***p < .001$.

features that influence the visual display of an app (e.g., child-friendly design, pace, structure). Although some identified features were similar to some formal features from earlier literature, others were different. A description of each individual feature can be found in Table 1.

Table 5. Predicting effects of child age and child sex on parental needs and moderating effects of child age and child sex on the relationship between parental needs and app features.

Age as predictor (RQ4a):

	Need for IE	Need for CE	Need for F	Need for TC	Need to PT
Child age	.02 (.01)	−.04 (.02)*	−.07 (.02)*	.07 (.01)*	−.03 (.02)

Age as moderator (RQ4b):

	Features CD	Features CaR	Features TCL	Features UoT
Need for IE x Child Age	.04 (.03)	.00 (.04)	.03 (.03)	−.05 (.03)
Need for CE x Child Age	.00 (.02)	.01 (.03)	.01 (.02)	.04 (.03)
Need for F x Child Age	.00 (.02)	−.03 (.03)	−.00 (.02)	−.03 (.03)
Need for TC x Child Age	−.05 (.03)	−.03 (.03)	.01 (.03)	−.02 (.04)
Need to PT x Child Age	.01 (.02)	−.01 (.02)	−.00 (.02)	−.01 (.03)

Sex as predictor (RQ5a):

	Need for IE	Need for CE	Need for F	Need for TC	Need to PT
Child sex	.04 (.04)	.03 (.04)	−.09 (.04)*	−.02 (.04)	.02 (.05)

Sex as moderator (RQ5b):

	Features CD	Features CaR	Features TCL	Features UoT
Need for IE x Child Sex	.18 (.09)* [.00, .36]	.12 (.12)	−.18 (.08)* [−.33, −.03]	−.17 (.10)
Need for CE x Child Sex	.04 (.07)	−.06 (.07)	.07 (.06)	.12 (.08)
Need for F x Child Sex	−.00 (.07)	.03 (.07)	−.03 (.06)	−.00 (.08)
Need for TC x Child Sex	−.12 (.08)	−.01 (.08)	.10 (.08)	.22 (.10)* [.02, .42]
Need to PT x Child Sex	−.01 (.05)	−.06 (.06)	−.14 (.05)* [−.23, −.04]	−.23 (.08)* [−.38, −.09]

Note. Unstandardized b coefficients (with SE between parentheses); controlled for parenting style, parental sex, parental education. Significant moderators show confidence intervals. IE = independent entertainment, CE = coeducation, F = familiarity, TC = tailored challenge, PT = pass time. TCL = tailored controlled learning, UoT = use of technology, CD = clear design, CaR = challenge and reward.
*p < .05.

Most important app features (RQ2)

While the results of RQ1 provide insight into the types of features that parents reflect upon when it comes to their children's apps, it does not offer a hierarchy of sorts—highlighting which features (or types of features) are more or less important (RQ2). The

online survey was designed to address this second question. Using parallel analysis, four overarching factors within app features were identified (see Tables 2 and 3).

In order of importance, 47.7% of parents identified features which support "clear design" (M = 3.90, SD = .44, α = .83) as important or very important when selecting apps for their children (i.e., 47.7% of all responding parents [N = 591] found the items loading on the factor "clear design" as important or very important). This factor consists of six items that reflect app features focusing on a clear design (e.g., clear and simple shapes, colors, moving objects, friendly characters), a clear purpose, and interactivity (reaction to touch).

Following this, 39.1% of parents identified features which support "challenge and reward" (M = 3.76, SD = .49, α = .82) as important in apps. This factor consists of seven items reflecting app features that refer to entertaining content, offering new content, rewards and challenges, and an option to customize.

Next, 37.6% of parents identified features which support "tailored, controlled learning" (M = 3.80, SD = .44, α = .85) as important when selecting apps for their children. This factor consists of 8 items which represent features that are tailored to age as well as enhance knowledge and skills, incorporate parental control settings, have an educational component (knowledge, skills, social, school-based, or creative), and provide in-app support.

Lastly, the least important set of features (noted by 4.7% of parents as important or very important) are those which support "use of technology" (M = 2.92, SD = .58, α = .77). This factor consists of six items reflecting parents' needs for an app to capitalize on the affordances of touch screen technology (e.g., reactive sound, coplay, multitouch, sliding).

The relationship between parental needs and app features (RQ3)

RQ3 asked whether the needs which parents express when it comes to apps for their young children are associated with app features that parents deem important for children's apps. Multiple regression models were used to evaluate the relationship between needs and each one of the four feature categories. Table 4 presents a complete accounting of these models.

Needs and "clear design" features. Results show that parents with a need for independent entertainment, b^* = .23, $t(578)$ = 5.46, $p < .001$; coeducation, b^* = .08, $t(578)$ = 1.99, $p < .05$; familiarity, b^* = .23, $t(578)$ = 5.99, $p < .001$; and a tailored challenge, b^* = .13, $t(578)$ = 3.16, $p < .001$, are more likely looking for features that focus on a clear design of an app for young children. Both a need for independent entertainment and a need for familiarity are equally strong predictors of this feature category.

Needs and "challenge and reward" features. Results show that parents with a need for independent entertainment, b^* = .10, $t(578)$ = 2.58, $p < .05$; familiarity, b^* = .13, $t(578)$ = 3.65, $p < .001$; and a tailored challenge, b^* = .43, $t(578)$ = 10.82, $p < .001$, are more likely looking for features that focus on challenges and rewards in an app for young children. A need for a tailored challenge is the strongest predictor of this feature category.

Needs and "tailored, controlled learning" features. Results show that parents with a need for coeducation, $b* = .40$, $t(578) = 11.70$, $p < .001$; familiarity, $b* = .24$, $t(578) = 7.09$, $p < .001$; and a tailored challenge, $b* = .21$, $t(578) = 5.66$, $p < .001$, are more likely looking for features that focus on tailored, controlled learning in an app for young children. A need for coeducation is the strongest predictor of this feature category.

Needs and "use of technology" features. Results show that parents with a need for coeducation, $b* = .12$, $t(578) = 2.97$, $p < .01$; familiarity, $b* = .15$, $t(578) = 3.95$, $p < .001$; a tailored challenge, $b* = .40$, $t(578) = 9.49$, $p < .001$; and pass time, $b* = .13$, $t(578) = 3.26$, $p < .01$, are more likely to be looking for app features that focus on the use of technology. A need for a tailored challenge is the strongest predictor of this feature category. Interestingly, the more parents express a need for independent entertainment, $b* = -.14$, $t(578) = -3.35$, $p < .01$, the less likely they are to attach importance to app features that focus on the use of technology.

The role of child characteristics (RQ4, RQ5)

RQ4 and RQ5 asked to what extent child characteristics (age, sex) may predict parental needs or moderate the relationship between parental needs and app features. Mediation models included child age or child sex as independent variable, all parental needs (i.e., need for independent entertainment, coeducation, familiarity, tailored challenge, and pass time) as mediating variables, and one app feature (i.e., clear design; tailored, controlled learning; challenge and reward; use of technology) as dependent variable—resulting in a total of eight models. See Table 5 for a complete accounting of these models.

Child age. Results indicate that while age does not moderate the relationship between parental needs and app features (RQ4b), it does have an indirect influence on features via some parental needs (RQ4a). In particular, age has an indirect effect on the importance of a clear design via the need for familiarity ($b = -.01$, $SE = .004$, 95% CI [−.02, −.006]) and a tailored challenge ($b = .01$, $SE = .003$, 95% CI [.002, .01]). For younger children, parents attach more importance to the need for familiarity and less importance to the need for a tailored challenge in apps. In turn, both needs increase the attached importance to an app's clear design.

Similarly, child's age has an indirect effect on the importance of challenge and reward (app feature) through the need for familiarity ($b = -.01$, $SE = .003$, 95% CI [−.02, −.003]) and a tailored challenge ($b = .03$, $SE = .01$, 95% CI [.01, .04]). Again, for younger children, parents attach more importance to the need for familiarity and they attach less importance to the need for a tailored challenge in apps. In turn, both needs increase the attached importance to challenges and rewards in apps.

Lastly, child's age has an indirect effect on the importance of the use of technology (app feature) through the need for coeducation ($b = -.004$, $SE = .003$, 95% CI [−.01, −.001]), familiarity ($b = -.01$, $SE = .004$, 95% CI [−.02, −.01]), and a tailored challenge ($b = .03$, $SE = .01$, 95% CI [.02, .05]). With younger children, parents attach more importance to the need for coeducation and familiarity, and less importance to the need for a tailored challenge in apps. In turn, all of these needs increase the attached importance to app features that focus on the use of technology in apps.

Child sex. Results indicate that sex has an indirect influence on app features via some parental needs (RQ5a), and also moderates the relationship between (RQ5b) parental needs and app features. In terms of indirect effects, there is a significant indirect effect of child's sex on the importance of tailored, controlled learning (app feature) through the need for familiarity ($b = -.02$, $SE = .01$, 95% CI [$-.04, -.003$]). It appears that, with girls, parents attach more importance to the need for familiarity which, in turn, increases the attached importance to tailored, controlled learning. There is also a significant indirect effect of the child's sex on the importance of challenge and reward (app feature) through the need for familiarity ($b = -.01$, $SE = .01$, 95% CI [$-.03, -.001$]). Again, for girls, parents attach more importance to the need for familiarity which, in turn, increases the attached importance to challenges and rewards in apps.

Beyond these indirect effects, results also show that sex is a moderator in the relationship between needs and features. Specifically, sex moderates the relationship between the need for pastime ($b = -.14$, $SE = .05$, $p < .01$) and tailored, controlled learning features such that, when parents express a need for pastime, they attach more importance to tailored, controlled learning features for girls than for boys. Sex also moderates the relationship between the need for a tailored challenge ($b = .22$, $SE = .10$, $p < .05$), pastime ($b = -.23$, $SE = .08$, $p < .01$), and the use of technology in apps. When parents express a need for a tailored challenge, they attach more importance to tailored, controlled learning features for boys.

Discussion

Guided by the assumption that parents play a key role in young children's media selection (Chiong & Shuler, 2010) and use (Nikken & Schols, 2015), this study aimed to provide insight into (a) the features that parents identify in apps for young children, (b) which of these features are considered most important by parents, (c) how app features are related to parental needs when it comes to apps for their children, and (d) the role of the child's age and sex in the relationship between parental needs and app features.

Apps' most important features to parents

Interviews with parents revealed 23 features in apps for children that they believe are important in app design. Parents suggest that apps should have a visually clear goal, entertainment features, friendly characters, tailored content that fits their child's knowledge and skills, and that apps should focus on enhancement of basic, creative, and social skills. Unsurprisingly, some of the identified features were identical to formal and content features that had been previously identified in other empirical research (e.g., Kucirkova et al., 2014; Plowman, 2015). However, earlier literature most typically characterizes features as rather technical and broad (i.e., features being defined as audiovisual features as well as content-related features). The app features identified by parents, although they do overlap with some formal features from earlier studies, are more functional and focused on the child's experience (i.e., the use of rewards, responsive sounds, in-app support, etc.).

Working with these features, we investigated whether they coalesce into categories that closely resemble formal features as described in earlier literature. We found that

these features do have shared variance and represent four broader categories, but the resulting categories differ from those highlighted in previous research. Specifically, we find that these features can be classified into the following four categories (in order of parents' attached importance to them): (a) clear design, (b) tailored, educational content that can be controlled, (c) challenges and rewards, and (d) technological innovation.

Most of these resulting categories seem to tie in directly with the affordances of touch screen technology, as opposed to more traditional (analogue) media content. For example, apps offering educational controllable content reflect parents' understanding that apps can allow them to control content by changing settings or preferences—something not possible with traditional media. Similarly, parents' preference for innovative technology as well as challenges and rewards is tied to how their children interact with apps. Thus, even though parents are primarily focused on the functional design of the app when they are selecting apps for their children (as evidenced by the highest priority on clear design), they also consider and value the (technological) affordances of new media.

The relationship between needs, features, and individual differences

Perhaps even more interesting than the features themselves, this study showed that parents' needs when it comes to apps for young children were—as U&G theory predicted—significantly associated with the app features they find important. We see, for example, that parents who express a need for coeducation (i.e., a tailored, controllable learning environment) attach importance to apps that rely on, among others, features which enable parents to set preferences and have a sense of control (tailored, educational, and controllable features). Similarly, parents who express a need for independent entertainment (i.e., self-guided and entertaining content for their child) attach importance to clear design features (i.e., apps which use a clear, simple, colorful design with moving objects, friendly characters, and a transparent goal). Considering that the principle of need fulfillment in U&G is that media which fulfill user needs will be enjoyed more and result in greater engagement and sustained use, the associations between parents' app needs and app features identified here seem particularly valuable for future app design.

In line with U&G theorizing, the needs that parents express as well as how these needs might be fulfilled (through features) vary by child age and sex. In particular, while age does not impact the need–feature relationship, it does play a role in the needs that parents express, which subsequently relates to the features of most interest. For example, age is positively associated with the need for a tailored challenge and negatively associated with the need for coeducation. In other words, it seems that for older children, parents are particularly interested in tailored, challenging apps, while for younger children they are primarily looking for educational, controllable apps with familiar objects or activities. These age differences are consistent with the moderate discrepancy hypothesis (Valkenburg & Cantor, 2000), which predicts that at any given age, a moderate level of stimulus complexity is preferred and that this level increases as children mature. In the case of apps, this explains why parents express a great need for paced, recognizable, and controllable content when children are young and, as children get older, express a greater need for more complex content.

Interestingly, while the needs parents express do seem to vary by age, the results also indicate that—regardless of age—the value that parents see in clear design features and

in challenging and rewarding app features relates to different needs. How can it be that the "same" features relate to parents' needs for different developmental groups? While at first it would seem that such a finding is at odds with the moderate discrepancy hypothesis, it is important to think about what these features might look like for two different age groups. For example, imagine a parent of a 3-year-old versus a parent of a 7-year-old. The results of this study indicate that a parent of a 3-year-old is likely to express a need for familiarity while a parent of a 7-year-old is more likely to express a need for tailored, challenging content. In both cases, parents believe that these needs can be fulfilled with clear design features and challenging, rewarding app features. How can these same features meet both needs? It is likely that the answer lies not in the feature categories themselves, but in the interaction between the features and the child's developmental level.

Specifically, a design that is clear to a 3-year-old may, in fact, be too simple for a 7-year-old. Similarly, a challenge or reward feature may be too complex for a 3-year-old but perfectly suited for a 7-year-old's developmental needs. Thus, while the feature category certainly provides insight into how to create an enjoyable app, it is crucial that developers carefully consider the developmental needs of their audience. In practice, this likely means narrowing the target age range for apps. Instead of creating an app that targets a wide range of ages (which is often the case in today's app market), it would be more desirable to create apps which target a smaller developmental window or which are uniquely able to address different age groups simultaneously (e.g., by altering content based on the age of the child via scaffolded content). Of course, this may seem a risky prospect to developers since a more narrowly defined audience may intuitively seem like a smaller chance of financial success. However, by tailoring content and narrowing to a smaller piece of the audience puzzle, developers may be better able to create more successful content by meeting the unique needs of their audience (see Hiniker et al., 2015, for evidence regarding developmentally appropriate app creation).

While age is certainly a meaningful construct for developers to thoughtfully consider, our results also suggest that the child's sex should not be forgotten. Interestingly, not only did sex influence the needs that parents expressed but it also played a role in the needs–features relationship. First, when it comes to needs, we found that parents who think of their daughter are more likely to express a need for familiar content than parents who think of their son. This need, in turn, relates to a higher preference for apps which rely on challenges and reward features, and features which support tailored, controlled learning. Moreover, when it comes to the relationship between needs and features, we found evidence for moderation. When parents express a need for an app to pass time, for girls, we found an increased preference for apps that use features that support tailored, controlled learning. For boys, however, parents more likely prefer features that rely on innovative techniques.

This moderation pattern for sex suggests that parents believe that girls are likely occupied by apps that have an educational goal presented in a tailored, moderately paced environment, while boys are better occupied by active, responsive apps that offer surreal events or enable coplay. This pattern seems in line with earlier research on sex differences in preferences for video games (Greenberg, Sherry, Lachlan, Lucas, & Holmstrom, 2010). Although focused on older children, Greenberg et al. (2010) found that boys prefer physically oriented games and girls prefer more traditional, thoughtful games. Parents may be

sensitive to these differences and therefore attach more importance to innovative flashy techniques for boys, while favoring quieter, controllable, and educational apps for girls. In fact, the results seem to suggest that the use of innovative techniques in apps may help pass time for boys, yet, for girls, the same feature might be a tailored challenge. In other words, parents seem to believe that while boys are easily occupied by innovative techniques in apps, for girls, this might make the app experience more challenging. The question that arises, then, is whether this is true or if, instead, this is a perception by parents that, to some extent, aligns with socially normative expectations associated with gender. As such, an important next step is to understand whether parents are accurate about the differences in needs by gender or if, instead, their expectations reflect a socialized assumption. In particular, efforts to understand whether features inherent in apps invoke an equal experience amongst boys and girls or if there are physiological, cognitive, or affective differences in response between the sexes would go a long way towards making inroads in understanding gender development and warding off potential gender inequality.

Moving forward

While previous research has given us an idea of the types of features that children's apps could include (e.g., Fisch, 2004; Goodrich et al., 2009), the current study is the first to provide detailed insight into the parental perspective on apps for young children. Through a multimethodological approach, the results of this study offer three key insights: (a) parents are primarily looking for apps with a functional design and strategic use of technology which relate to their media needs, (b) parents believe that children's apps should be tailored to the age of the targeted child user, and (c) parents believe that certain app features are more appropriate for boys while others are more suitable for girls.

More broadly, however, this study also offers important theoretical and applied contributions. Theoretically, this study highlights a way to apply U&G in a somewhat nonconventional manner by investigating a dual audience. Typically, in U&G scholarship, the media user and the media selector is one and the same. In this situation, the media selector is the parent whereby the media user is the child. Previous work has shown that parents' needs reflect both their own needs as a parent as well as their child's needs, but there are no studies, to our knowledge, that have attempted to link these needs to the media content. We hope that future work continues to identify the extent to which U&G can be successfully employed with more diverse definitions of audience. Along with this, from an applied perspective, we believe that the findings may assist children's app designers as they seek to create apps that are best suited for young audiences.

That said, it is important to note that we see this study as a first step towards a better understanding of parents' selection process when it comes to apps for children, and would encourage researchers to extend this line of work in several ways. First, there was no existing measurement of important app features in apps for young children; thus, the measure used here was developed for this study. This development was particularly complex given the many different features that parents noted. Efforts to validate this measure by establishing test–retest reliability, construct validity, and cross-population validity would be a valuable next step. Observational data would also be a particularly meaningful way of validating the measure. Moreover, replication and extension of this measurement

would also be quite valuable. In the design of this measure, we focused on what features parents consider important in a "good" app without asking about the reverse (i.e., features that they find problematic, such as in-app purchases). One can imagine that broadening the interview in this way could reveal important boundaries or contexts to consider in app design, as well as potentially reduce the opportunity for social desirability in the scale. Relatedly, it is important to recognize that parents can only base their ideas on what they have experience with. The app market is quickly changing, and with it comes new features that may fulfill needs in ways we do not yet know (see Sundar & Limperos, 2013, for a discussion about Uses and Gratifications 2.0). As such, replication and extension within the app domain may offer methodological refinement and highlight new opportunities that apps can fulfil.

Beyond apps, efforts to extend this measurement to other emerging media domains (e.g., robotics, virtual reality) would be equally worthwhile. While the items used in this study would not be easily transferrable to other domains, scholars may learn from our process of measurement development here—particularly our use of the laddering technique—to inform the design of similar measures. As the media space becomes increasingly diversified and personalized, it will become increasingly important to understand the media selection process, especially for parents of young children.

Outside of measurement, it is equally interesting to obtain greater insight into how parents' perceptions are shaped. While empirical scholarship has shown that parents are looking to fulfill one or more needs when selecting apps for their children (Broekman et al., 2016), how these needs are formed remains far less understood. We know that with traditional media, such as television, parents often turn to their social network (i.e., spouse, family, peers, other parents) as well as public policy organizations (e.g., pediatric organizations) to ascertain opinions about media, and these interactions warrant further research (e.g., Lapierre, Piotrowski, & Linebarger, 2014). However, whether and the extent to which parents are engaging in similar behaviors when it comes to mobile apps remains unknown. Similarly, we do not fully understand the role of parental individual differences in this process. For example, our models suggest that parenting style and parenting education (covariates in our analyses) may be worth an a priori investigation. Although scholars (e.g., Broekman et al., 2016) have shown that parenting style is associated with parental needs, this and other literature have yet to evaluate how such variables may shape needs over time.

Alongside this, it would be advantageous for scholars to better understand the evolution of parental needs and how this evolution is influenced by their child's individual differences. For example, in the work presented here, we see that child's age influenced the needs parents expressed and, by extension, the app features they preferred. It is likely that these developmental patterns would be even more robust if a larger age sample was used. For instance, consider media control. In our sample of parents of younger children, parents value features that allow them to control media *content.* However, if our sample had included parents with a larger child age range, we might have seen that expressed parental needs and the desired feature landscape would also be broader—with parents of younger children preferring *content* control and parents of older children perhaps preferring *time* control. This notion that child characteristics may have an ongoing and changing influence on parental needs is consistent with U&G argumentation which suggests

that individual differences are crucial in understanding media selection and experience. Indeed, by replicating and extending both the needs measurement and feature measurement used in this study with a broader age population, scholars would be better poised to identify shifts that occur in parental needs as well as the changing role that parents have in their children's media use as their child becomes a more autonomous media selector and user.

Beyond this, it is crucial to understand whether and how the inclusion of these identified app features benefits children. At present, we assume that fulfilling the needs parents express through incorporating features in children's apps will qualitatively improve the app experience of young children. This assumption remains an important question for follow-up empirical research. If in fact, the inclusion of particular features does not affect children's app experience, this would suggest that the needs that parents articulate for their children are not necessarily the ones that media developers should focus upon. On the other hand, if particular features can positively affect children's app experience, such information can be incredibly helpful in designing apps for young children.

And lastly, from a practical perspective, based on the findings presented here, we advise media creators to include the perspective of parents in the design process. In particular, fulfilling parents' needs through applying their perspective on app features in apps for children should not only increase parents' willingness to select these apps for their children, but hopefully will enhance the app experience for the child user. Based on this work, this means creating apps which have a functional and clear design; incorporate a basic, creative, or social educational goal; and target a narrow developmental window. And while it remains unclear how sex differences arise, media creators should recognize that parents do believe that sex influences media preference and, as such, should consider the best ways to create content that can meet the preferences of boys and girls. Given the socialization power of media, creating content that pushes back against the stereotypical notions of sex may be an important direction for helping ensure that the pink and blue dichotomy that is so often present in children's toys and media is replaced with a color-neutral approach which de-emphasizes gender and instead focuses on intrinsic interest.

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