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Sharing Culture in a Tech World: Grandparent-Grandchild Cultural Exchanges Over Video Chat

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Abstract

Grandparents who were separated from their infant grandchildren during COVID-19 sought

other ways to connect, including video chat. Video chat supports learning, and its features (e.g.,

contingent responsiveness) may allow for cultural exchange. However, technological problems

may disrupt these exchanges. In a semi-naturalistic, longitudinal study, 47 families submitted up

to three video chats and surveys. Families were predominantly White/Caucasian, highly-

educated, and lived between 1 and 2700 miles apart. Multilevel models were used to predict the

proportion of the sessions devoted to exchanging culture (e.g., holidays, parenting advice) and

managing tech problems. Culture exchange did not change as a function of infant age, video chat

experience, or when encountering tech problems. Although only marginally statistically

significant, culture exchange increased as distance increased. Tech problems changed as a

function of tech talk. A qualitative analysis revealed that cultural transmission occurred via a

culture of care and sharing of information across video chat, that families adapted their behaviors

to the new technology, and that technology disruptions rarely interfered with the flow of

information. These findings demonstrate the ability to share culture when physically separated

and in the presence of tech disruptions. Further, this study supports previous work on the

emerging culture of video chat. Families adapted to being separated, and grandparents and

infants successfully communicated through a new modality. Because video chat supports family

relationships, equitable access to high-speed internet should be a priority to enable more families

to use it.

Keywords: video chat, COVID-19, grandparents, infants, culture exchange

Public Significance Statement

This study demonstrates that video chat allowed for familial culture exchanges to be

maintained through separation during COVID-19. Examining what and how cultural exchanges

took place suggest that supports for using video chat, including access to high-speed internet, are

necessary for families separated by other circumstances.

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Introduction

Since March 2020, the COVID-19 pandemic has upended people's lives around the world. State-mandated social distancing protocols and stay-at-home orders impacted family interactions as public health recommendations disconnected grandparents, who were more vulnerable to the virus, from their adult children and grandchildren (Santini et al., 2020). Separation and social disconnectedness increased older adults' symptoms of anxiety and depression (Santini et al., 2020). During stay-at-home orders, many families turned to video chat to stay connected and maintain relationships, a 21st-century strategy that has been positively associated with two markers of well-being: satisfaction with life and positive emotions (Brown & Greenfield, 2020). Cultural exchanges are critical for maintaining family relationships at a distance because the strength of family relationships over time depends, in part, on how culture is transmitted across the generations (Rothbaum et al., 2000). This study examines how video chat provides opportunities for sharing culture between grandparents and their grandchildren when families are unable to gather in person.

Video Chat Interactions with Infants

Video chat is deemed an exception to the American Academy of Pediatrics guidelines that recommend limiting screen time for children under 2 years of age (Reid Chassiakos et al., 2016), and many Americans relied on video chat during the pandemic (Pew Research Center, September 2021). For families with children 5 years and under, calls lasted around 20 minutes and included mostly child-centered interactions with grandparents and other relatives (e.g., David & Nelson-Kakulla, 2019; Strouse et al., 2021; Tarasuik & Kaufman, 2017). Video chat is enjoyed by grandparents because it allows them to be involved in their grandchildren's lives and gives them the sense of "being there" (Ames et al., 2010).

To know what types of information might be meaningfully shared with infants over video chat, the question of whether infants can learn from video chat must be addressed. Although young children often may not learn as much from video as from live interactions (for reviews see Barr et al., 2007; Strouse & Samson, 2021), learning via video chat can be more effective than learning from a pre-recorded video (e.g., Myers et al., 2017; Troseth et al., 2006). For example, children under 2 years of age learned both social and cognitive information from a video chat partner who was interactive and responsive (Myers et al., 2017). But very little work has examined what information grandparents and infants share during video chat interactions and how families use video chat to maintain their family culture when physically apart.

Cultural Shift to Technology: Cultural Exchanges, Technological Barriers and Video Chat

Laland and Hoppitt (2003) define culture as "group-typical behaviors shared by members of a community that rely on socially learned and transmitted information" (p. 151). Cultural transmission in humans is primarily achieved through teaching, imitation, and language (Legare, 2017; Tomasello et al., 1993). The ability to transmit culture via direct teaching and imitation requires early socio-cognitive skills, which include a child's understanding that another person is an agent that should be attended to in order to learn from them, and the child's ability to map others' actions onto their own through perspective taking. Additionally, Tomasello and colleagues (1993) argued that transmission occurs via collaborative learning, consisting of more complex back-and-forth interaction between social partners. For instance, in a diary study conducted with 12- to 18-month-olds in New Zealand, infants imitated cultural conventions of shaking hands and the *haka* (a Maori ceremonial dance; Barr & Hayne, 2003). In another study, American toddlers who learned actions modeled by their parents accurately imitated the new skills while being supported by their parents' praise

and coaching (Brezack et al., 2021).

Rogoff (2003) famously observed that "human development is a cultural process" (p. 4) and that families devise culturally appropriate ways to care for young children that are adapted to fit changing circumstances and involve various social partners. Rogoff and colleagues observed children as they learned via social engagement with caregivers in everyday activities embedded within their cultural context, acquiring their group's specific values, beliefs, and practices (e.g., weaving) by intently observing adults' expert displays (Rogoff et al., 2015, 2018). In western cultures, this kind of learning-by-observing occurs in early childhood (e.g., for learning language) before being largely supplanted by formal instruction (Callanan et al., 2011; Rogoff et al., 2016).

The COVID-19 pandemic certainly introduced changing circumstances that required adapting to maintain family closeness. Whether and how cultural transmission via video chat might occur with very young children has not been documented. Cultural transmission through collaborative sharing and the involvement of different social partners is likely to be feasible via video chat: it allows for socially contingent responses through two channels of constantly-updating information (audio and visual, Mayer, 2003) which can support children's learning (e.g., Myers et al., 2017; McClure et al., 2018). According to parent reports, participating in family celebrations and other significant events over video chat helped young children feel integrated into the family unit despite being separated geographically (Tarasuik & Kaufman, 2017). When families articulate their "values, rituals, practices, and beliefs" such as religion and heritage information with remote grandchildren through video chat, family identities are reinforced (Ames et al., 2010; Forghani & Neustaedter, 2014).

Since video chat became commercially available in 2003 it has supported families separated by distance due to immigration, incarceration, and deployment. However, families report experiencing technological problems and barriers to engaging in cultural exchanges while using this medium (Zosh et al., 2022). Prior to the pandemic, 40% of grandparents reported that they used video chat and other forms of technology to stay connected, but many also said they did not feel comfortable with the technology (David & Kakulla, 2019; Zosh et al. 2022). Older adults also expressed concerns over cost and security of internet access (Kakulla, 2021). For many families, lack of stable and reliable internet access made video chat less useful, and barriers to communication arose when they experienced delays in connection or unintended termination of calls (Katz et al., 2019). These technical interruptions may threaten the ability of family members on video chat to interact with each other in socially contingent and responsive interactions.

Whether problems with technology impact intergenerational cultural transmission has not yet been demonstrated. Infants are highly sensitive to both audio-visual asynchrony and breaks in social communication. Studies have demonstrated that infants as young as 5 months old are affected by interruptions in social communication and attempt to regain an adult's attention (e.g. in the still face procedure; Goldstein et al., 2009). Other studies have shown that infants detect changes in audio-visual synchrony, showing slow visual recovery when presented with offset audio-visual content or switches to unimodal audio or visual content (Bahrick & Lickliter, 2000). Because poor internet stability and connectivity often results in a loss of audio or visual information, infants may find this aversive or may become inattentive. Therefore, the social context of technical disruptions is important to examine.

Families report that they are motivated to overcome technological problems (Zosh et al., 2022). In prior observational studies, parents supported their children during lags or disconnection by talking to them about the malfunction (McClure & Barr, 2017) and spontaneously engaged in "tech talk" to orient their children on how to use devices (Lauricella et al., 2014). Overcoming these disruptions may be generating a new intergenerational culture (Legare, 2019), or set of shared group-typical behaviors, surrounding the use of video chat with young children.

Observational research on cultural exchanges with very young children through video chat is particularly novel; prior studies are survey reports mainly focused on children older than five years of age (Ames et al., 2010; Forghani & Neustaedter, 2014; Share et al., 2018) but socio-cognitive skills for collaborative learning are developing in infancy (Tomasello et al., 1993). While technology adoption by older adults is increasing, there are many unknowns regarding how to best include these users in the digital space (Weil et al., 2021). The present study will reduce this gap and expand research to an age group younger than 5 years old by investigating how, when, and what types of cultural exchanges occur over video chat, and how and when technological problems occur.

The Present Study

During the pandemic, participation in video chats became a common family practice (Pew Research, September 2021; Strouse et al., 2021). From a methodological point of view, collecting recordings of families engaged in video chatting with each other allowed for a slightly less obtrusive method for collecting data from multiple family members compared to having observers in the home. It also was one data collection method that was possible during the pandemic. This study examines the use of video chat to support families' cultural exchanges

and the technology problems that occur during these chats with children across three time points, using an observational approach and coding interactions between grandparents, parents and grandchildren from recordings of Zoom calls.

Culture is rooted in rituals, both sacred and secular, and is a collective phenomenon among a community (Nielsen, 2018; Legare, 2019). Based on Legare's (2017, 2019) theory of cumulative cultural learning, we operationalized a cultural exchange as a shared experience when families exchange information that directly involves a) the child and b) family cultural practices including: holidays, religion/traditions, conventional gestures, storytelling, meals, popular media, clothing, parenting advice, and use of heritage language. Mealtimes were included because Rogoff (2003) noted that when comparing individuals, it is also useful to consider situations that have similar functions across cultures. Parenting advice was included as a category of shared information, given that advice intersects closely with cultural norms (Bornstein, 2012). Further, based on prior observational studies of video chat interactions (McClure & Barr, 2017), we coded instances of technological problems, tech talk, and when the infant touched the device as a new category of intergenerational shared information. This plan produced the following quantitative research questions:

RQ 1.1: What types of cultural exchanges take place during video chat?

RQ 1.2: Are cultural exchanges associated with video chat experience, technological problems, and geographic distance?

RQ 1.3: Are technological disruptions associated with video chat experience, technological talk, and geographic distance?

To more fully explore the types of cultural exchanges that took place, we then conducted a qualitative analysis of all the actions that had been coded quantitatively as a

cultural exchange or a technological disruption. Using an inductive approach (Williams & Moser, 2019) we examined the following questions.

RQ 2.1: How is culture exchanged?

RQ 2.2: How are technological disruptions occurring and being navigated?

RQ 2.3: What is unique/new to video chat as a shared family experience, i.e., is a new "video chat" culture forming?

In this exploratory study, we tested models that predicted the proportion of time spent on cultural exchanges and the proportion of time spent on technological problems and qualitatively explored how cultural exchanges occurred.

Method

Participants

Recruitment

Grandparent-parent-infant triads with an infant born from December 2019 and throughout 2020 were recruited for this study. Triads were recruited from individual parents and grandparents who completed a prior survey (Strouse et al., 2021) and additional families were recruited through Children Helping Science, preexisting lab and institutional listservs, online forums for families, local retirement and senior centers, and general and targeted Facebook ads. Participants were compensated for their time and received a $5 e-gift card for each survey completed and a $10 e-gift card for each video recording. Advertisements were posted in English and Spanish. To be eligible, all members of the triad needed to live in the U.S. or Canada and have access to an electronic device (tablet, computer, phone, etc.) connected to stable Wi-Fi.

Final Sample

Recruitment began in August 2020 and continued until December 2020 by which time 50

triads were successfully recruited. We excluded three families from the final sample who only submitted one recording each.

Although parents and grandparents of any gender were welcome to enroll in the study, those who volunteered were overwhelmingly female. The final sample included 47 triads: infants (17 girls, 30 boys), grandparents (all grandmothers), and parents (43 mothers, 4 fathers). At the time of the first video chat, infant average age was 9.70 months ($SD = 2.57$), grandparent average age was 62.77 years ($SD = 6.91$), and parent average age was 33.35 years ($SD = 4.55$). The sample was largely homogenous with most participants self-identifying as White/Caucasian (95.83% grandparents and 95.83% parents), with 2.08% grandparents identifying as African American and 2.08% of parents identifying as mixed race. Regarding ethnicity, 4.17% of grandparents and 10.42% of parents reported that they were Latino/a/x and 4.17% of grandparents did not report. The sample was also highly educated. Education was measured on a 7-point scale, but the first three low-incidence categories (lower than high school/ high school/ GED) were collapsed. For grandparents, 8.33% reported no high school/high school/GED, 20.83% a 2-year degree/trade school, 27.08% a 4-year college degree, 22.92% a master's degree and 18.75% a Ph.D., M.D. or law degree. For parents, 2.08% reported no high school/high school/GED, 6.25% a 2-year degree/trade school, 35.42% a 4-year college degree, 29.17% a master's degree and 25% a Ph.D., M.D. or law degree. The average geographic distance between family members was 631.8 miles ($SD = 719.09$ but the data were skewed, median = 421.53 miles). Distance was estimated by calculating the miles between the latitude and longitude coordinates associated with each party's zip code and/or place name. Following similar approaches in the literature (e.g., Davey et al., 2009; Strouse et al., 2021) to control for skew in the data, distance was logarithmically transformed prior to inclusion in analyses.

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Instrumentation

Surveys were collected from both parents and grandparents at the beginning of the study and prior to each video chat. All parents and grandparents completed a 90-item enrollment survey in Qualtrics, and we report demographics and geographic distance from this survey. Prior to each video chat, the parent and grandparent each completed a 160-item follow-up survey on REDcap. From these surveys, we report items related to the frequency of in-person and video chat contact between the infant and grandparent.

Demographic Variables. Demographic questions covered parent/infant and grandparent age and geographic location and parent and grandparent race/ethnicity and education.

Frequency of Contact. Parents and grandparents reported how often the grandparent had interacted with the infant "over video chat," ranging from Every day (4), A few times a week (3), A few times a month (2), Less than once a month (1), Never (0).

Procedure

Consent and survey data were collected using Qualtrics and REDCap, and video chats were recorded via Zoom. At least one month following the enrollment survey ($M = 1.98$ months, $SD = 0.90$ months), parents and grandparents completed a ~15-minute REDCap survey prior to their first video chat. Subsequent surveys were sent at two-month intervals for a total of three REDCap surveys associated with video chat recordings. Data was collected over a 4-month period. For example, if the infant was 12 months old at the first video chat, another video chat would be collected at 14 months and a third when the infant was 16 months old.

Prior to their first video chat, participants met with experimenters via Zoom. During this meeting, researchers oriented families to Zoom and requested that participants aim to record at

least 15 minutes and include all three participants on camera. Families received Zoom links and recorded the sessions without an experimenter. Videos automatically recorded to the Zoom cloud. The protocol for the study was approved by the Georgetown University Institutional Review Board.

Variables Calculated from Parent and Grandparent-Submitted Surveys

Infant Video Chat Experience. Following Roche and colleagues (2022), at each time point, parent/grandparent responses to frequency items (every day (4) to never (0)) were averaged to create family-level video chat frequency scores. Then family-level frequency at each time point was multiplied by the child's age to provide an estimate of the cumulative amount of video chat contact the child had participated in by each time point. That is, a 12-month-old child who had been chatting once per week had more cumulative video chat experience than a 6-month-old child who had been chatting once per week. Multiplying frequency by age therefore resulted in a new variable to estimate the total amount of infants' *video chat experience*.

Coding Passes

Video chats varied in length. Submitted videos that were longer than 25 minutes were truncated to that length, resulting in an average video chat of 18.00 minutes ($SD = 5.57$). Zoom recordings were uploaded to Box for secure storage, and Datavyu spreadsheets were created for coding. Datavyu is open-source software that allows coders to attach codes to video timestamps (Datavyu Team, 2014).

Culture Coding. Cultural exchanges were coded when directly involving the target child through a shared experience. The primary coder coded both the category and the duration of each exchange into the following categories: holidays, religion/traditions, gestures, storytelling, traditions, meals, clothing, parenting advice, popular media, and heritage language (See Table 1

for definitions of each code). A second coder trained until they coded categories to criterion on a

training set to $\kappa = .70$. Then reliability was assessed by double coding categories for 24.8% of

videos ($n = 34$). Coders achieved a kappa of .84 for categorizing cultural exchanges. Total

cultural exchange was computed by calculating the proportion of the video recording's duration

the triads spent exchanging culture for each category type.

Table 1

Culture Coding Protocol

Category	*Definition*
Holidays	A holiday (e.g., Thanksgiving, Christmas, Hanukkah) is mentioned that involves the child. For example, the grandparent asks the baby if he/she was excited for Christmas.
Religion/ Traditions	Any general mention or display of religious service, belief, or any other related concepts. For example, the grandparent asks if the baby took part in a family tradition (like a regular family Zoom) or whether the baby went to church.
Clothing	Any mention or display of a piece of cultural clothing such as for holidays or religious traditions. For example, the grandparent asks what the baby wore for Christmas.
Conventional Gestures	Shared cultural gestures included handshakes, bowing, dancing, singing nursery rhymes, and other nonverbal communication rituals such as blowing kisses. For example, the grandparent and parent playing and singing Patty Cake with the baby.
Storytelling	A discussion of the family's past such as the grandparent telling stories or reminiscing about what the parent was like when they were younger. For example, the grandparent talks about how the mother played with similar toys as a baby.
Meals	Grandparents eating with the target child or interacting with them as the child is eating. For example, the grandparent interacting with the baby while the parent feeds them a meal.

Parenting Advice	Discussion where grandparents offer the parent advice or requests information about one of the four categories of sleep, safety, nutrition, and socialization. For example, the grandparent asks how the baby was sleeping at night.
Popular Media	Sharing a song from visual media or popular culture that is not accompanied by specific, traditional gestures.
Heritage Language	Amount of time spent in exchanges of heritage languages (defined as non-English language shared during the video chat).

Technology Coding.

Tech Talk. Tech talk was coded when families referenced audio/visual issues and when an adult encouraged or discouraged the infant regarding technology. Specifically, tech talk frequency was coded as discussions of audio issues (e.g., reminding the grandmother to unmute), discussion of visual issues (e.g., grandmother asking parent to move the camera to better see the infant), and either encouragement or discouragement regarding technology (e.g., telling the infant that touching the device will make grandma go away).

Technological Problems. Tech problems that disrupted the conversation were broken into two categories: problems caused by the technology itself (e.g., internet disconnection) and problems caused by a video chat participant (e.g., accidentally turning off the camera). The duration of the disruption was categorized as either time to resolution of the problem or time to the call's termination resulting from the problem.

Infant Device Touches. Infant device touches were coded when the infant attempted to make contact with the device. These touches were successful when contact was made and unsuccessful when the action was impeded, such as when a parent prevented the infant from completing the touch.

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   Reliability. A second coder coded the occurrence of each code to criterion on a training

set ($\kappa = .70$). Reliability was assessed by double coding the categorization of technology codes

for 23.9% of videos ($n = 33$), achieving a kappa of .87.

Model Building

   Growth Models. To address our research questions regarding cultural exchanges and

technological problems, we used hierarchical linear modeling to fit growth models using the *lmer*

function (Bates et al., 2015) in R (R core team, 2021) and maximum likelihood estimation. To

control for differences in exchanges and disruptions due to children's age at the time of the video

chat, growth models to address research questions two and three were grand mean centered on

the infant's age ($M = 12.15$ months, $SD = 3.5$).
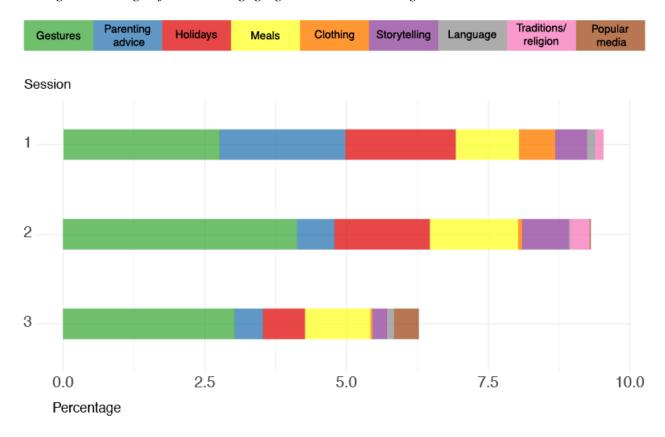
Results

RQ1.1 What types of cultural exchanges take place during video chat?

Descriptive Statistics

   Overall, 9% ($SD = 10\%$) of the video chat was spent in cultural exchanges (see Figure 1).

Technological problems accounted for 6% ($SD = 14\%$) of the time spent on video chat and tech

talk occurred during 9% ($SD = 8\%$) of the video chat sessions (Table 2). Playful activities ($M =$

21%, $SD = 17\%$), conversations unrelated to culture or technology (e.g., mother telling

grandmother what happened before the video chat), and watching the infant play accounted for

the remaining time. Gestures were observed the most, an average of 3.68% ($SD = 0.85\%$), while

religion and traditions were coded the least ($M = 0.15\%$, $SD = 0.16\%$). Cultural exchanges

around holidays ($M = 1.57\%$, $SD = 0.39\%$) and meals ($M = 1.33\%$, $SD = 0.41\%$) were also

relatively more frequent than other types of cultural exchanges. Perhaps, not surprisingly, there

were clusters of holiday expressions around the major holidays (e.g., Thanksgiving and the

holiday season, Valentine's Day in February, Easter/Passover/Ramadan in the spring) and fewer

in the summer (Figure 2). These holiday experiences were shared via video chat when families

could not meet in person.

Figure 1

Average Percentage of Session Engaging in Cultural Exchange

Infant device touches were the most frequent tech behaviors with an average of 0.26

touches/minute ($SD = 0.31$).

Table 2

Tech Behaviors by Session

	VC1		VC2		VC3		Total	
	M	SD	M	SD	M	SD	M	SD

Tech Problems	0.04	0.04	0.06	0.10	0.08	0.23	0.06	0.14
Tech Talk	0.09	0.08	0.08	0.06	0.11	0.09	0.09	0.08
Infant Device Touches	0.31	0.38	0.25	0.30	0.37	0.33	0.26	0.31

Note: The number of codes per minute are reported for tech talk and infant device touches.

Technological problems are reported as a proportion of the video duration spent managing

technical disruptions.

Figure 2

Plot of cultural exchanges about holidays as a function of date.

RQ 1.2: Are cultural exchanges associated with video chat experience, technological problems,

and geographic distance? Prediction of Cultural Exchanges

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To address the second research question, we established a growth model predicting the proportion of recorded video chats spent exchanging culture. Based on an unconditional means model with scores nested inside of family (fixed and random intercept only) the ICC was .301. Age fixed effects account for unobserved factors that changed across time but are common at a particular age. Since there are rapid developmental changes across infancy, infant age was centered on the grand mean age across the time points. Although there were no significant fixed effects of infant age, the model with fixed slopes had slightly better fit than the unconditional model based on the AIC, so we retained fixed effects of infant age. Including random effects of age led to singular fit, suggesting the model was overfitted, so random effects were not retained.

We then incorporated predictors of interest into the growth model. The final model included level one predictors, including an estimate of video chat experience, proportion of time spent managing technological problems, proportion of time spent discussing technology, and level two predictors, including log-transformed distance between grandparent and infant and family ID. Table 3 provides the growth model and final model which accounted for 29.2% of the variability in cultural exchange. Geographic distance and proportion of time engaging in tech talk were positively associated with cultural exchange, though the relationships ($p_{distance}$ =.14; $p_{tech\ talk}$ =.12) did not meet traditional statistical significance. No variables were significant predictors of cultural exchange.

Table 3

Model for Cultural Exchange - Comparison Growth and Final Model

	Growth Model				Final Model			
	Estimate	*SE*	*t*	*p*	Estimate	*SE*	*t*	*p*
Intercept	0.08***	0.01	7.86	<.001	0.05	0.04	1.29	.20

Infant age in Months	0.00	0.00	0.09	.89	0.00	0.00	-0.20	.46
Geographic Distance (log)					0.01	0.01	1.48	.14
Video Chat Experience					0.00	0.00	-0.21	.84
Tech Talk					-0.22	0.14	-1.58	.12
Tech Problems					-0.10	0.09	-1.18	.24
Num.Obs.	132				132			
SD of Random Effect for Intercept	0.05				0.05			
AIC	-237.1				-237.1			
RMSE	0.08				0.08			

Note. Infant age in months ($M = 12.01$ months, $SD = 3.35$) was grand mean-centered.

[+]$p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

RQ 1.3: Are technological disruptions associated with video chat experience, technological talk, and geographic distance? Prediction of Technological Problems

Following the same model building approach used for culture, we tested models

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predicting the proportion of the session engaged in tech problems with fixed and random slopes.

Like model 1, although there were no significant fixed effects of infant age, the model with fixed

slopes had slightly better fit than the unconditional model based on the AIC, so we retained fixed

effects of infant age. Including random effects of age led to singular fit, suggesting the model

was overfitted, so random effects were not retained.

We then incorporated predictors of interest into the growth model. Level one predictors

of technological problems included an estimate of video chat experience and frequency of tech

talk (per minute) collected at each time point, and level two predictors were geographical

distance and family ID. Table 4 provides the best-fitting growth model and final model.

Including geographic distance and video chat experience led to singular fit, suggesting the model

was overfitted, so neither of these variables were included in the final model.

The final model (Table 4) accounted for 4.4% of the variability in technological

problems. Problems were more frequent when tech talk was more frequent ($b_{\text{iech talk}} = 0.21$, $p = $

.128), though the relationship was not conventionally significant.

Table 4

Model for Proportion Managing Technological Problems - Comparison Growth and Final

Model

	Growth Model				Final Model			
	Estimate	*SE*	*t*	*p*	Estimate	*SE*	*t*	*p*
Intercept	0.03**	0.01	3.22	.003	0.02	0.01	1.52	.131
Infant age in Months	0.00	0.00	1.50	.136	0.00	0.00	1.14	.254
Tech Talk					0.21	0.14	1.53	.128

Num. Obs.	132	132
SD for Intercept	0.02	0.01
AIC	-227.6	-227.7
RMSE	0.09	0.10

Note. Infant age in months (*M* = 12.01 months, *SD* = 3.35) was grand mean-centered.

$^+p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Qualitative Analysis

After establishing the frequencies of family cultural exchanges and tech disruptions, an inductive qualitative analysis (Williams & Moser, 2019) was conducted to better understand how family culture was transmitted in these moments, including how families adapted to the constraints of video chat and technological disruptions. This qualitative analysis was guided by three questions:

RQ 2.1: How is culture exchanged?

RQ 2.2: How are tech disruptions occurring and being navigated?

RQ 2.3: What is unique or new to video chat? Is a new video chat culture forming?

Two coders reviewed all of the portions of the videos that had received quantitative culture or tech codes, took descriptive notes, and engaged in open coding. We then used an axial approach and to integrate the information into the themes below (Williams & Moser, 2019). We sampled from each time point and coded until we reached saturation for each theme. From this

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process, five themes emerged in response to our research questions.

Research Question 2.1

The following themes arose while answering the question, "How is culture exchanged?"

      Theme 1: Collaborative Reciprocal Interactions. Families exchanged culture by engaging in reciprocal, multidirectional communications that incorporated all members of the family. Grandmothers and parents engaged in reciprocal back-and-forth conversations directly including the infant. These exchanges were often embedded in a game or a song that occurred frequently and often in specific formats during the recordings. These were taught either directly and reinforced or indirectly through imitated actions. The exchanges often occurred as part of a greeting at the beginning or end of the call and involved waving and kissing, either as blowing kisses or leaning toward the computer for a kiss. During the games, they also did high fives or clapped to encourage the infant.

      Many of the conversations served the purpose of connecting the grandmother to the infant's daily life. While sharing a meal, the grandmother taught the infant how she peels and eats an orange while the infant ate her own orange. Grandmothers also asked about events that took place in the infant's life, asking the infant for details that the parent provided. Sometimes these conversations did not include the infant, such as when grandmothers asked the parent what food the infant likes and the exchange stays between the adults.

      Theme 2: Sharing history and experiences. Families exchanged culture by using video chat to share unique experiences and histories with one another. Grandmothers used this passing along of knowledge to share family history with the infant and parent. Many grandmothers used pictures or objects, like a plate that the parent's sibling made, to connect the infant to their parent's childhood. This show-and-tell was accompanied with stories, songs, and games. When

singing songs, grandmothers often proceeded without teaching the others the words or dances, assuming the others knew them. Occasionally, grandmothers checked in and taught the songs if needed. Parents also shared knowledge with the grandmother to connect her to the infant's environment. In one instance, the infant's mother showed the grandmother the infant's jingle bells and encouraged the baby to shake the bells while singing "Jingle Bells." While many songs were familiar to the grandmother, parents also shared new songs that the infant enjoyed.

Theme 3: Culture of Care. Families exchanged culture by using video chat to express care and concern for each other. Parenting advice was offered by the grandmother most often from a place of caring. Grandmothers asked the parents about the infant's health and offered suggestions based on doctor's reports or concerns expressed by the parents. After noticing an infant's low energy on screen, grandparents might suggest an early nap or bedtime to the parent. For example, a concerned grandmother helped a mother brainstorm ways to increase the infant's weight after a doctor's office check-up. Parents also asked their parents questions about concerns they had about their child, prompting the sharing of advice. While most were approached in this caring manner, some grandmothers were more direct with their advice with one confirming, "You're not going to stop breastfeeding, are you?" after hearing some feeding challenges the mother experienced.

Research Questions 2.2 & 2.3

The remaining themes emerged when considering both, "How are tech disruptions occurring and being navigated?" and "What is unique or new to video chat? Is a new video chat culture forming?"

Theme 4: Video Chat Adaptations. Families did make adaptations to video chat when accommodating the constraints that video chat presented. During meals or snacks, infants were

able to "share" with grandma by extending food toward the screen. When infants were not as engaged, grandmothers used noises (beeps) or big gestures (waving hands) to grab their attention. They adapted conventional gestures of high fives and "cheers" gesture raising their hands or glasses to connect via the screen. Grandmothers also were aware of the constraints of what the infant could see from the screen and adapted dances for nursery rhymes ("Itsy, Bitsy, Spider") to keep her hands within the frame. Some grandparents adapted "Head, Shoulders, Knees, and Toes" to include their belly button instead of legs to keep their hands visible. Some were not as successful at remembering what the infant could see on-screen.

Theme 5: Continuing after Disruption. Technological disruptions frequently did not disrupt the flow of the interactions. In one adaptation of giving their grandmother a high five, the infant held their hand up to the camera. The grandmother's video froze mid-gesture, and the infant kept their hand up to wait for grandma to return. During other video disruptions, the adults continued talking through the frozen or stopped video. There were, however, some instances where the disruptions were acknowledged. If help was needed to troubleshoot a disconnection, one adult provided suggestions to the other, such as finding the unmute button or turning on the camera. Often, parents provided these suggestions with patience, though some experienced frustration. Other technological disruptions were caused by the infant turning off the camera, but parents adeptly turned it back on again. Sometimes brief mentions about a video or audio lag were made when the issue was resolved (e.g., "Now you're back") or families treated it as a game (e.g., "Where's Grandma?") when the signal was lost, before continuing where the conversation had left off.

Discussion

The present study serves as a critical step in understanding how video chat can be used

as a tool for cultural exchanges and whether technological problems are associated with exchange and enjoyment. Our approach was based on a socio-cultural theoretical perspective (e.g., Rogoff, 2003; Rogoff et al., 2018). We examined infants starting late in their first year, when they acquire socio-cognitive skills that allow for collaborative learning (Legare, 2017; Tomasello et al., 1993), interacting during everyday events via video chat. Due to the timing of the study, we also examined how families adapted to a new circumstance: separation due to the pandemic (e.g., Rogoff, 2003; Rogoff et al., 2018). We examined the data both quantitatively and qualitatively to include both the frequency of cultural exchanges as well as more descriptive information regarding how families transmitted culture. Cultural exchanges and some technological disruption occurred in most video chats as indicated by the quantitative analysis. The qualitative approach identified themes of collaborative interactions, sharing of history and experiences, culture of care, and adaptations to video chat.

Gestures were the most frequent exchange, and included teaching the baby how to blow and receive kisses across the screen, mimicking a form of affection in Western culture. The qualitative analysis complemented these findings and provided more detailed information about how gestures were being used to share culture, e.g., that grandparents and babies were doing them together in a mutual interaction, or using them as a way to show and tell one another about their experiences.

Across the quantitative and qualitative findings, we saw patterns of cultural transmission where families adapted to the constraints of video chat and social distancing. Via video chat they continued to share traditions including information about holidays and parenting advice, began new traditions by adding conventional gestures to start and end the video chat, and provided support to one another via a culture of care and sharing of knowledge

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around games and technology.

These findings are consistent with those from an observational study conducted prior to the pandemic in which McClure and Barr (2017) also discussed the creative ways that families simulate physical touch through video chats. Parents encouraged their young children to hug or kiss the device as a proxy for their on-screen grandparent who could similarly respond. Parents then physically kissed the baby, transferring the grandparent's affection to the infant (McClure & Barr, 2017). Like McClure and Barr (2017), we also observed that grandparents and parents often involved the baby in conventional games such as peek-a-boo and gesture-based nursery rhymes (e.g., Patty Cake). Parents held the babies' hands to imitate and follow the grandparents' cues as they sang. The pretend physical interactions resulted in enjoyable activities for both parties.

Meals and holidays were the next highest instances of cultural exchange. Many of the first video chats happened during the holiday season (see Figure 2) when families used video chat as an opportunity to discuss their plans and later, the child's first Thanksgiving, Christmas, or another holiday. In one instance, the grandparent asked if the infant had put out the menorah in preparation for Hanukkah. Meals were also common cultural exchanges, with grandparents serving as conversation partners during the meal. The qualitative analysis showed how grandparents and parents included infants in these events and were able to adapt to the constraints of the video chat space, for example by having the same food on each side of the screen. Many families opted to tell stories about the family, with many involving the infant's parent when they were the infant's age. Taken together, these findings suggest that families used the video chat sessions for intergenerational meaning-making between the youngest and oldest family members.

Parenting advice focused on four areas: sleep, nutrition, safety, and socialization, and a culture of care theme emerged from the qualitative analysis. Some parents and grandparents checked in with each other about the health of various members of the family while infants were on the video chat. Other studies have examined how parents had conversations with their 3- to 8-year-olds about COVID (Haber et al., 2022; Ünlütabak, B. & Velioğlu, 2022) and in the current study, we observed how infants overheard such discussions between their parents and grandparents.

Some categories of cultural sharing occurred less frequently. Some families shared content from popular media, such as songs from *Sesame Street*. Religion/traditions, such as talking about going to church, were observed the least. Clothing was also discussed infrequently, with some grandparents making comments about the child's clothes, but many did not. Though rare, heritage language exchanges included short phrases or singing traditional songs.

None of the predictors in the growth model of proportion spent in cultural exchanges were significant. However, there was one notable trend of more cultural exchanges as geographic distance increased, consistent with previous literature on long-distance family relationships (Share et al., 2018). Although we observed cultural exchanges in these physically separated triads, more work is needed to understand how well these exchanges transmitted culture between generations. We proposed that video chat's ability to synchronize audio and visual input from afar in real time (Mayer, 2003) would aid in cultural transmission through imitation (Legare, 2017; Tomasello et al., 1993). Previous passes of coding these recordings have captured imitation; thus, further analysis of imitation and culture is required to test this theoretical model.

Family separation during COVID-19 presented many challenges to grandparents. Finding new ways to exchange culture with the newest family members while apart became a problem to solve, but the video chat solution came with barriers of its own. Technological problems disrupted sessions, but the amount of cultural exchange was not disrupted by technological problems; rather the qualitative analysis showed that families persisted through technological disruptions such as disconnection due to low connectivity and infant touches to the device. Technological disruptions were accompanied by tech-focused talk. These conversations served to help the other party reconnect or to explain the tech problems to the infant. These interactions align with previous work suggesting a new culture around video chat (McClure & Barr, 2017). Consistent with previous literature (Ames et al., 2010; Forghani & Neustaedter, 2014), families in our sample used video chat as a strategy to overcome the separation barriers of exchanging culture when apart.

Limitations and future directions

There were several limitations to the present study. Our sample was predominantly White, English-speaking, and middle class. Heritage languages play an important role in familial transmission of cultural practices. In Share et al.'s (2018) study of Polish immigrants living in Ireland, all participants wished for their children to speak Polish to maintain their heritage. By speaking their heritage language, the families displayed intergenerational solidarity between second and third generations (Share et al., 2018) potentially benefiting infants' communication skills from multilingual exchanges (e.g., Liberman et al. 2017). Meaningful analyses of heritage languages were not possible since families rarely used them during these video chats. Future research should include a more diverse sample that would enable comparison of cultural exchanges across different racial groups and monolingual and multilingual families, and tests of

imitation, language, and teaching as ways to transmit culture (Rogoff et al., 2018) in the context of video chat. Additionally, a more diverse sample might include families where intergenerational beliefs vary, influencing the types of cultural exchanges that might take place over video chat (Forghani & Neustaedter, 2014).

These well-resourced families experienced few technological challenges and were able to respond to them using "tech talk." However, many low-income families and those separated by incarceration or migration have "underconnectivity" (inconsistent access to the internet) due to factors including high subscription costs, poor bandwidth in rural communities, poor bandwidth due to multiple users, and underperformance of older devices (Katz et al., 2019). Such underconnectivity disrupts video chat's utility. To understand how cultural exchange can be maintained via video chat and whether it can be sustained despite technological barriers, a more diverse sample is needed.

Translational applications.

Cultural exchanges during early grandparent-grandchild relationships may facilitate and support positive intergenerational connections early in life. The results of this study make the case that video chat can serve as a tool for cultural exchanges and that families have adapted flexibly and quickly to this relatively new technology. There are three key takeaways:

1. *Technology implication: Families rapidly adapt to new technologies even through disruptions.* Grandparents and infants were introduced to a new modality for communication, joining this new culture of technology together. Many grandparents reported that they did not feel comfortable with technology (David & Kakulla, 2019; Zosh et al. 2022) but also stated that they were motivated to overcome technological barriers (Zosh et al., 2022). In the present study, despite disruptions occurring about 9% of the time, themes of continuing the video chat visit

after disruption clearly demonstrated that families were able to not only persist through this

disruption but also creatively adapt to the constraints of video chat, modifying games and

cultural conventions (e.g. playing peek-a-boo by disappearing off screen and coming back on

screen).

2. *Cultural sharing implication*: *Families use video chat to engage in cultural exchanges.*

Zosh and colleagues (2022) surveyed parents and grandparents during the pandemic and

identified barriers to staying connected via video chat. While most, although not all,

grandparents and parents had access to devices and the Internet, many reported that they were

not comfortable with how to engage with very young children via video chat. Thus, beyond the

ability to access and use devices for video chat, learning *how* families use devices and offering

support to families navigating this uncertainty is important. The present study provides empirical

evidence that families were able to flexibly adjust to the challenges presented while using video

chat with young children and that video chat can provide opportunities for important cultural

exchanges. Further, this work provides these exchanges occurred frequently, and also concrete

examples of how families can transmit culture over video chat. In particular, grandparents and

parents shared family stories and memories, which are known to support identity development

(Chen et al., 2021). They also shared meals, games, and songs, which serve important cultural

functions (Rogoff et al., 2018). By learning how families naturally share culture over video chat,

we can help offer guidance to families new to using video chat with young children and

potentially help increase the amount of time spent sharing cultural practices over video chat.

3. *Policy implication: Equitable access to high-speed internet is needed.* The current

sample was well-resourced; studies of more representative groups show that while almost all

families have access to devices, many families are under-connected (e.g., Barr, 2022; Katz et al.,

2019). Given that families were able to engage in a culture of care via video chat during the pandemic and that there are likely other benefits of family connection (Strouse et al., 2021), an important policy implication is that access to high-speed internet is necessary so all families can utilize this technology for sharing culture and building strong family relationships at a distance.

Taken together, this work suggests that while the families in this sample were flexibly able to video chat with young children, there remains many potential gaps and avenues for interventions for families that are less well-resourced. A potential first step would be to help support virtual interactions with young children by providing guidance for families. One approach that has been successful in improving language outcomes for young children has been via caregiver-directed, "light-touch" interventions that modeled behaviors for parents through multimedia modules (Suskind et al., 2016). Similar educational materials with brief suggestions for supporting infants' interactions on video chat could improve parents' and/or grandparents' fluency when connecting online with loved ones. This could be particularly helpful when access to video chat is limited (e.g., during incarceration and/or when access to technology is limited) and/or in breaking down stressor-related barriers to video chat (e.g., when families need extra support to use video chat due to discomfort, normalizing tech disruptions, responding to a global health emergency).

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