Families on Facebook

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Abstract

This descriptive study of millions of US Facebook users documents "friending" and communication patterns, exploring parent-child relationships across a variety of life stages and gender combinations. Using statistical techniques on 400,000 posts and comments, we identify differences in how parents talk to their children (giving advice, affection, and reminders to call) compared to their other friends, and how they address their adult sons and daughters (talking about grandchildren and health concerns, and linguistically treating them like peers) compared to their teenage children. Parents and children have 20-30 mutual friends on the site, 19% of whom are relatives. Unlike previous findings on family communication, interaction frequency on Facebook does not decrease with geographic distance.

Introduction

Facebook's widespread adoption by users of all ages coupled with its focus on reflecting offline relationships has resulted in parents and children "friending" each other in vast numbers. Two thirds of American parents of teens use a social networking site, mostly Facebook, and 80% of them have friended their child (Madden et al. 2012). The interaction on Facebook ranges from high-schoolers and their parents supplementing the communication they have every day at home, to older parents, viewing photos of their grandkids shared by their adult daughters and sons.

Given the prevalence of family relationships on Facebook and on other computer-mediated communication tools, one common question is whether social media are changing the quality and frequency of communication with family members, both collocated and geographically distant ones. In this paper we examine one kind of family relationship on Facebook, that of parent and child, where the word "child" denotes the social role of offspring, and not age. Facebook users are 13 and older, so we document a wide range of parent-child relationships at many life stages. We quantify friending behavior (who "friends" whom and when), mutual friends, and how communication varies with the age of the child and geographic distance. We find that nearly 40% of Facebook users have either a parent or child on the site, and that communication frequency does not decrease with geographic distance, unlike previous research on family communication.

Using a wealth of anonymized, aggregated intra-family communication data, we also paint a detailed picture of what parents and their children talk about on Facebook. Consistent with offline research, we see mothers doling out affection and reminding their kids to call, and fathers talking about specific shared interests, such as sports and politics. Grandchildren and food are common topics. We also identify a linguistic shift when parents talk to their grown-up children compared to how they talk to teens, treating their 40 year-old children much like they do their other adult friends. Facebook contains what is perhaps the largest database of parent-child communication ever amassed. With sample sizes in the millions for parent-child relationships at nearly every age, it provides a unique opportunity to explore parent-child communication from adolescence through adulthood.

Related Work

We begin by reviewing offline research on family relationships and then discuss the role of social technology for collocated and extended families.

Parent-Child Relationships and Communication

As children mature, communication with their parents reflects their passage through life stages. Adolescence introduces challenges with independence; therefore, a great deal of research focuses on how parents talk about risk-taking behaviors such as sexual activity and alcohol use. Communication with adult children shows decreased strain between children and both parents, and decreased frequency of contact with mothers as children grow out of adolescence (Umberson, 1992). However, parents generally have regular and frequent contact with their adult children (Um-

berson 1992) though communication frequency decreases with geographic distance (Lawton and Silverstein 1994; Dubas and Petersen 1996).

Mother-child relationships differ from father-child relationships, in part due to the differences in male and female communication patterns. For example, men tend to emphasize facts whereas women focus on interpersonal relations, empathy, and support (Block 1983) and place a greater importance on close emotional bonds between family members (Silverstein, Parrott, and Bengtson 1995). Given these gender differences, it is not surprising that mothers and fathers differ in how they communicate with their children. Fathers tend to be more authoritarian than mothers with sons (Block 1983), whereas mothers focus on the child's opinions (Fitzpatrick and Vangelisti 1995; Stewart, et al. 1996). Mothers may also have a higher frequency of contact than fathers with their adolescent and adult children (Umberson 1992).

The child's gender affects communication patterns. Mothers talk more about emotions, thoughts, and feelings with daughters than with sons (Garner, Robertson, and Smith 1997; Stewart et al. 1996). Daughters also receive more parental affection and disclose more to parents than do sons (Fitzpatrick and Marshall 1996). Both parents encourage their sons more than daughters to be independent and to control their feelings (Block, 1983). Mother-daughter relationships involve more contact and emotional closeness than mixed gender or male adult child-parent relationships (Lye 1996; Lawton and Silverstein 1994). Also, parents receive visits and help from daughters more often than sons (Spitze and Logan, 1990). Taken together, this research shows mother-daughter relationships involve more frequent and emotional communication than other parent-child combinations, with father-son relationships being the least emotionally charged.

This paper extends the above research on parent-child relationships to explore how parental communication differs from that between non-related adults. Using more granular data than traditionally available, we examine in depth how communication frequency varies with the child's age, geographic distance, and gender.

Computer-mediated family communication

While social media provide opportunities to study parent-child communication in detail, they also have the potential to change that communication, making it easier to talk with geographically remote family, and introducing new concerns about privacy and communication quality that are not issues in face-to-face communication. Much of the literature on computer-mediated communication among families focuses on the impact of technology, both for better and worse.

Long before Facebook, parents and children used a variety of Internet platforms for communicating, including email, photo-sharing sites, blogs, videoconferencing, instant messenger and shared calendars. Much of the literature focuses on extended family—relatives who do not live in the same house (e.g., Tee, Brush, and Inkpen 2009; Cao et al. 2010). Time-zone differences are a primary issue (Cao et al. 2010), and so many family members turn to asynchronous media, like email or the web. While people report wanting to communicate more with geographically remote family members, and in fact feel guilty about not doing it enough, they are wary of assuming new burdens and are concerned that online communication may be perceived as more trivial than phone calls or in-person visits (Tee, Brush, and Inkpen 2009). Photos and news of children and grandchildren are a primary motive for communicating (Tee, Brush, and Inkpen 2009).

For families with adolescents, research centers on the tensions surrounding teens' use of social technology, particularly cell phones and social network sites. One common concern is that technology facilitates peer communication at the expense of the family (Subrahmanyam and Greenfield 2006). Higher levels of family conflict are associated with teens' use the Internet for social purposes, but not when they use it for education (Mesch 2006). Parents are also concerned that their teens' online behavior will affect their reputation or future career prospects (Subrahmanyam and Greenfield 2008; Madden et al. 2012).

Many of the concerns from just three or four years ago stem from social network sites being the havens of young adults; parents rarely had accounts. For example, a study in 2008 found that approximately half of the parents of adolescent MySpace users had rarely or never seen their teen's profile (Rosen et al. 2008). This was understandable, as teens would sometimes use tricks—such as multiple profiles or fake data—to avoid their parents finding them (boyd 2008).

While many of these concerns are still valid today, Facebook changes the equation, with both parents and teens among the active user base. Two-thirds of parents of children aged 12-17 now use a social networking site, up from 58% in 2011, and 80% of them have "friended" their child (Madden et al. 2012). Parents use social network sites both to monitor their teens and to make their presence known, in an effort to mitigate bullying and bad behavior (Lenhart et al. 2011; Madden et al. 2012). One-third of parents have helped their teens with privacy settings, and parents who use social media themselves are far more likely than non-users to have conversations with their children about privacy (Madden et al. 2012). Teens' feelings about their parents' presence on Facebook are mixed, depending on pre-existing levels of openness or conflict in the relationship (Kanter, Afifi, and Robbins, 2012; Westermann 2011). Some teens feel an obligation to "friend" their parents, and

report feeling like they have to behave differently when they know their parents are watching (Madden et al. 2012).

With so many parents and their children both on Facebook, we seek to answer basic questions about their relationships. These questions include:

RQ1. How common are parent-child relationships on Facebook? How does it vary with age and gender?

One way for parents to feel greater control over their teens is to be connected to their children's friends, as well. Being "Facebook friends" often allows parents to see what their children and their children's peers are sharing. And as children mature, they form relationships with neighbors and other adult friends of their parents. So, we want to understand who these mutual friends are, examining their ages and relationships to the focal parents and children.

RQ2. Connections: Who "friends" whom, and when does it happen? What is the composition of their mutual friends?

Offline interactions differ by age and gender of the parent and child, but this has not been studied on a large scale, leading us to devote the bulk of the paper to the following questions.

RQ3. Communication: How often do parents and children communicate on the site, and how does it vary with the child's age, geographic distance, and gender?

RQ4. How do the subject matter and linguistic properties of conversation between parents and children vary by age and gender?

Method

To explore family relationships on Facebook, we built a dataset consisting of all English-speaking, monthly active US users who had specified at least one other user as their parent or child using the site's relationship tool. Relationships could be declared by either the child or parent, but did not need to be confirmed by both sides. Instances in which parents and their children are simply "friends" but haven't declared the family connection are therefore not included, but by comparing our numbers to those from Pew (Madden et al. 2012), we believe we are capturing the majority of parent-child relationships. Biases from unreported relationships are discussed at the end. We restricted the sample to parent-child pairs with at least a 16-year age difference to remove instances of teens declaring other teens as their "parent." The site's terms of service require users to be at least 13 years old, so therefore parents in our sample were at least 29.

Communication and Relationship Data

To understand friending dynamics, for each parent-child pair we pulled the time at which the friendship was initiated, when it was confirmed by the other person, when the users each joined the site, their total numbers of friends, and the friends they have in common. We also pulled counts of three months' communication data for each individual beginning mid-September 2012. Because we are exploring dyadic relationships, the data consisted of content directed at another person—any Facebook friend, including their parent or child—including comments, posts, and links shared on another's Timeline, but not broadcast content like status updates. Chat volume surpasses other forms of communication but is biased toward the subset of people who use it, and the text is often too short and noisy for substantive language analysis, so chat was also excluded from analysis. Ways in which the results might differ with chat are discussed at the end.

To model language predictive of parent-child relationships, we went through several text-processing steps. The end goal was to generate text features that would be used in a regression modeling whether the communication target was a family member or not, described below. To generate the text features, we pulled the text from a 1% sample of all directed communication written by the users in the study for the same three months and generated frequency counts for all n-grams up to three words long. Also, because rare terms would lead to overfitting, terms written by fewer than 1,000 people (out of millions) and that appeared fewer than 10,000 times were excluded. Punctuation was removed and numbers were replaced with <number>. Stopwords, highly frequent words such as articles, were included as their use has been connected to many social phenomena (Pennebaker, Francis, and Booth 2001), but following convention, n-grams consisting entirely of stopwords were removed. Common US first names[1] were removed. In the end, this left 57,964 n-grams in the dictionary, such as: *happy birthday, tried calling, baby, are so lucky, really like this*.

A random sample of 100,000 communication exchanges (posts and comments, hereafter called "posts" for simplicity) was pulled for each of four categories: parent-to-child, parent-to-other (someone who is not their child), child-to-parent, and child-to-other. These N = 400,000 posts were automatically converted into unordered counts of n-grams as described above. Through this sampling, we have very few instances of non-independent user-level observations (e.g. multiple posts within the same parent-child pair), and so we do not apply multilevel modeling. All data was processed automatically and in aggregate, such that no individually identifiable information was visible to researchers.

[1] http://www.ssa.gov/OACT/babynames/names.zip

Statistical Method for Language Analysis

Our goal in language analysis is to understand how social role (e.g., parent or friend) influences how people talk to partners on Facebook. Therefore, we treat the problem as a logistic regression, e.g. using all posts written by parents as input, and setting the binary outcome measure, *to child*, equal to 1 if the target is the parent's child, or 0 otherwise. We use a similar technique for other sets of interest, such as children writing to their parents (the input is all posts written by children, and the outcome, *to parent*, is 1 if the target is his or her parent, and 0 if it's another Facebook friend). By including posts written by the same demographic set (e.g., parents) to multiple classes of targets (e.g. child vs. another friend), we control for language that might otherwise simply be predictive of the author's age and sex, and only identify terms that are especially good at differentiating parent-child relationships from others.

Regression performs best when features are independent, but natural language terms are highly correlated (e.g., *happy* frequently co-occurs with *birthday*). Therefore, we apply a common technique known as elastic-net logistic regression (Friedman, Hastie, and Tibshirani 2010). This technique has been used elsewhere to model power imbalances in the Enron email corpus (Gilbert 2012) and sociocultural identity in tweets (Eisenstein, Smith, and Xing 2011). This method works well when the number of features is large and collinear. Elastic net regression has a parameter, α, ranging from $\alpha = 0$, in which correlated terms are all included but their resulting coefficients are shrunk toward each other (also known as ridge regression), to $\alpha = 1$ (known as lasso regression), in which only one representative term per correlated cluster is included, and all other correlated terms have their coefficients shrunk to zero. In our case, after comparing the accuracy and most predictive n-grams from models using $\alpha \in [0, 0.1, 0.5, 1]$, we used $\alpha = 0.1$, a nice compromise between ridge and lasso regression that results in conservative coefficients indicating the likelihood that a post containing that term was written to the target of interest (e.g., in Table 1, from parents to their children, with regression coefficients translated to odds ratios for ease of interpretation).

Results

We begin by describing the prevalence of parent-child relationships on Facebook. Overall, 37.1% of English-speaking, monthly-active US Facebook users have specified either a parent or child relationship on the site. Figure 1 presents a breakdown by age[2]. Approximately 40% of

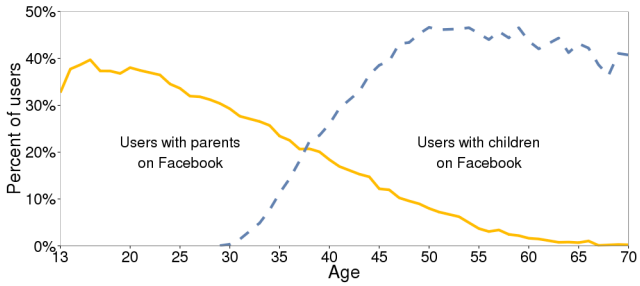

Figure 1. Percentage of users by age who have specified a parent (solid line) or child (dashed line) on Facebook.

teens have specified a parent, peaking at 16 year-olds, 39.7% of whom have a parent on Facebook. Nearly half (46.6%) of users age 50 have a child on the site. Mother-daughter ties are most common (41.4% of all parent-child ties), followed by mother-son (26.8%), father-daughter (18.9%) and father-son (13.1%).

Friending

Children and parents are acquainted long before they become Facebook friends. Once on Facebook, for some pairs, friending is immediate, but others wait. Of the pairs who have friended one another, 19.3% did so within a month of the second person joining, but on average, the time elapsed is 371 days. The second person to join is more likely to send the friend request, independent of the child's age and whether the requestor is the child or parent. Younger teenagers typically join Facebook after their parents, so younger teens are more likely to initiate the friend request. Adult children are more likely to have joined before their parents, and so are more likely to be on the receiving end of the friend request.

Parent-child ties are not isolated within the Facebook friendship graph. They are often surrounded by mutual friends (19.4% of whom are also designated as relatives).

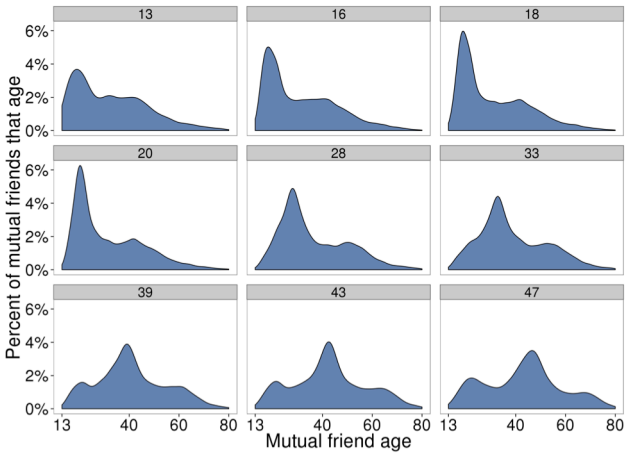

Figure 2. Ages of parent-child mutual friends, faceted by child's age. For teens and young adults, most mutual friends are around the child's age, with some around the parent's age. Older children and their parents have mutual friends at three generations: parent, child, and grandchild.

[2] In all figures with child age as the x-axis, users with ages ending in 2 (e.g., 22, 32, 42) have been omitted due to an anomaly in the data (small spikes in self-reported round birth-years like 1990 or 1980) that is independent of the present research and makes the graphs difficult to interpret.

Shared Facebook friends who represent specific familial ties include, in order of frequency: cousins, siblings, aunts and uncles, and the other parent. Figure 2 shows the age distribution of mutual friends. Mutual friends of younger teens and their parents tend to be closer in age to the teen, rather than the parent. These mutual friends are likely the child's siblings, cousins, and peers. This is consistent with the notion that parents of younger teens want to be a visible presence on Facebook; these data suggest that they do that in part by friending some of the child's peers. For college-age children, the distribution is more clearly bimodal, with mutual friends coming from both the child's and parent's age groups. For children in their late 30s to late 40s, we see a *trimodal* distribution, as those children have their own kids old enough to use Facebook, and mutual friends span three generations. Mothers and daughters have the most mutual friends (median=34), followed by mothers and sons (27). Fathers share relatively fewer mutual friends (23 with daughters and 22 with sons), despite having an 18% larger social circle, on average, than mothers. The proportion of shared contacts between parents and children also increases with age (Figure 3).

Communication Volume

Only a small percentage (1-4%) of directed communication from parents is to their children, with mothers writing four times as often as fathers. There is a jump in communication for college age children which is sustained as the child gets older (Figure 4). An additional bump appears between mothers and their daughters of childbearing ages, possibly where the women discuss parenting and family life, and share photos of the grandkids. Children only devote about 1% of their posts to their parents, and it decreases with age; either parents play a lesser role as children grow older or older parents are less active on Facebook. Again there is a jump around age 18 as teens move out of the home.

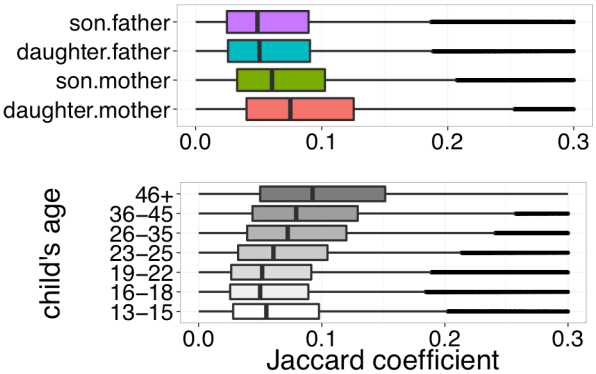

Figure 3. Overlap in friendship circles between child and parent based on gender (top) and child's age (bottom). Overlap is measured as the Jaccard coefficient (# of mutual friends divided by the size of the set of all their friends). Daughter-mother pairs share a greater percentage of their social circles than other pairs, and network overlap increases with the age of the child.

Geographical distance itself reveals interesting patterns. As Figure 5 shows, daughters and sons move the same distance on average during college years, and the distance increases from then on. However, daughters over 30 live closer to their parents than do sons. In contrast to prior studies showing a decrease in other forms of contact with

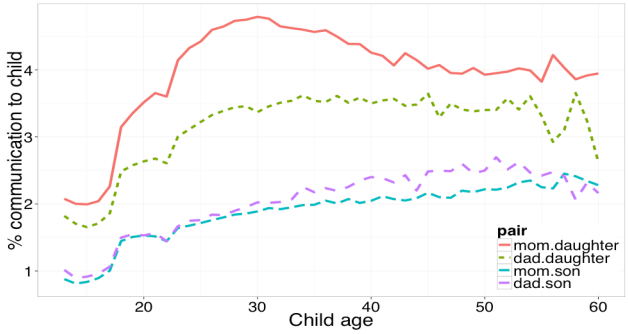

Figure 4a. Percent of a parent's posts targeted at his or her child.

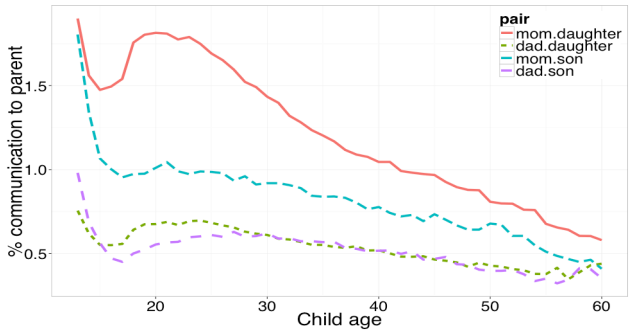

Figure 4b. Percent of a child's posts targeted at his or her parents.

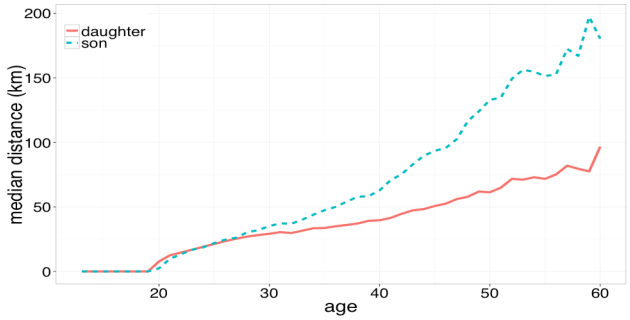

Figure 5. Geographical distance from parent as a function of child age and gender.

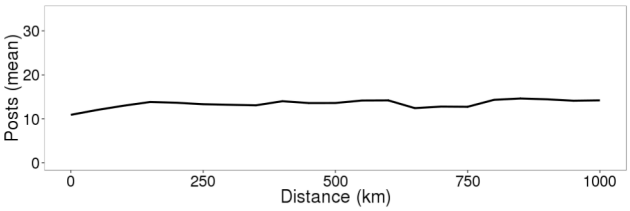

Figure 6. Posts between parents and children over three months. Communication frequency on Facebook does not decrease with geographic distance.

Parents writing to their children

Phrase	Odds	Phrase	Odds	Phrase	Odds	Phrase	Odds	Phrase	Odds
love mom	3.32	gets that	2.34	this might	2.14	honey	1.95	homework	1.88
week from	3.10	babygirl	2.34	are you getting	2.12	to marry	1.95	hey what	1.88
that anyone	2.97	http apps	2.34	she isnt	2.12	g ma	1.95	found your	1.86
tried calling	2.89	dad	2.32	you come over	2.12	earrings	1.93	baked	1.86
night or	2.86	http apps facebook	2.29	knows how	2.10	two of my	1.93	i remember it	1.86
copy of this	2.83	carving	2.27	this today	2.10	yes very	1.93	love dad	1.86
grammy	2.77	dr oz	2.27	i just realized	2.08	i am shocked	1.93	didnt u	1.86
home with you	2.72	has lost	2.25	when i read	2.08	came over	1.92	stinker	1.86
papa	2.64	school work	2.23	grandma is	2.08	miss her too	1.92	munchkin	1.84
ur sister	2.61	takes after	2.23	daughter	2.08	kiddo	1.92	necklace	1.84
no thanks	2.59	taught you	2.23	am shocked	2.05	you were born	1.92	luv you	1.84
it twice	2.51	love ya both	2.23	now see	2.05	tried to tell	1.90	what ya	1.84
son	2.51	here we come	2.20	oh sorry	2.03	mija	1.90	you learned	1.84
of them lol	2.48	your room	2.20	pretending	2.03	remeber	1.88	your brothers	1.84
waking	2.41	te amo	2.18	at ur	2.01	assist	1.88	hummmm	1.82
dolly	2.39	keep working	2.18	go shopping	2.01	hack	1.88	you lmao	1.82
car with	2.36	will get there	2.18	your mother	2.01	she like	1.88	makes my heart	1.82
second one	2.34	your sister	2.18	mommie	1.99	for taking care	1.88	your father	1.82
you sick	2.34	favorite song	2.16	lov u	1.97	eye out	1.88	for a great	1.82
her new	2.34	gamers	2.14	be quiet	1.97	are crazy	1.88	hija	1.80

Table 1. The top 100 phrases associated with a Facebook message being sent from a parent to his or her child. A message containing *tried calling* is 2.9 times as likely to be sent by a parent to his or her child, rather than to another friend.

distance (Dubas and Petersen 1996), we find that communication frequency remains constant with geographical distance (Figure 6), with a very slight positive correlation ($r = 0.05$, $p < 10^{-15}$) between distance and number of posts. This pattern of steady communication over distance holds for both genders and whether or not we control for age.

Communication Content

Next we turn to the substance of their communication—what are parents and children saying to each other on Facebook? To accurately model this phenomenon, we used a series of elastic-net logistic regressions, as previously described. Table 1 presents the top terms from the model. The score next to each term indicates the odds that a post containing that term was targeted at that parent's child, rather than at another friend[3]. For example, a post containing *love mom* is 3.3 times as likely to be aimed at a child rather than one of the parent's other friends. A post with *tried calling* is 2.9 times as likely to be going to a child. This technique distills terms that are distinctly predictive of family communication, not just terms that are popular on Facebook. So, while *love you* appeared in almost 5% of the posts across all users in the sample, parental affection was more often expressed as *love mom* or *love dad*. Similarly, *thank you* was common within and outside families, and so is not predictive. The model distinguishing parent-child and parent-other communication is 59.4% accurate on an 80/20 train/test split. This accuracy is clearly better than chance but only modest; however, it is quite good considering the relatively short message lengths and the fact that the model does not take into account any demographic features of the speaker or target, simply their words. As the goal of the research is to identify trends in communication rather than build a perfect classifier, this model performs adequately.

Parents to their Children

The differences in how parents talk to their children and how they talk to other friends include both substantive content and simple linguistic contrasts. Parents reference phone calls and visits (see Table 1): *tried calling, you come over, please call us, trying to call, your phone, coming home*[4] and give advice to their children: *keep working, listen to your, forget to, remember, stay out, is the right, good advice.* Not surprisingly, parents use more affection (*love mom, love ya both, i ♥ you)* and terms of endearment with their children (*babygirl, dolly, honey, mija, kiddo, stinker, munchkin, my princess*). Grandchildren are a common topic (*takes after, grandbabies, grandson, my grandchildren)*, consistent with previous studies of families (Tee, Brush, and Inkpen 2009), and consistent with the bump in Figure 4a when daughters are of childbearing age. Parents also share online games with their children more than with other friends (*http apps facebook*). The simple linguistic differences are highly predictive and include shifting references to other family members: when talking to children, parents say *grammy* and *papa*, but when talking to other friends, they say *my mom*, *my niece*, and *mom and dad* (rather than *grandma and grandpa*).

What parents say when they're not talking to their children is just as revealing; they use higher levels of ideology

[3] Odds ratios are the exponentiated regression coefficients.

[4] Tables only show the top terms from the regressions for space; additional terms are included in the text. All terms have an odds ratio >= 1.5.

(*agree but, obama, our government, policies, people need to, ethics*), swearing and slang (*ctfu, lmao, fucker, idk*), and alcohol and sex terms (*tequila, glass of wine, that ass, sexy*). Parents address a wide variety of friends, and so more formal language is also predictive of communication with non-children, such as explicit efforts to send goodwill *(birthday to your, tell your mom, regards to, thanksgiving to you, be well, congrats, much love to*), condolences (*condolences, your loss, so very sorry*), and salutations (*greetings, saludos*). Though these phrases are warmhearted, this linguistic formality reflects relationships that are less close than those of parents and children (Brown and Levinson, 1987). Several Spanish terms also appear (*te amo, mija, hija*); though users in the sample have English as their primary site language, multilingual users were not excluded.

To identify further structure in the differences between parents speaking to children and friends, we applied several of the dictionaries from the LIWC package (Pennebaker, Francis, and Booth 2001) to the original post text. This way, we not only learn which terms are most predictive (from the regression), but also whether parents cover topics with different frequencies when talking to their children versus their friends. From the literature and the themes in the regression coefficients, we identified eleven LIWC categories expected to differ between groups: Affect (e.g., *love, happy, sad*), Family (*daughter, husband, aunt*), Social (*call, visit, share*), Home (*bedroom, house, kitchen*), Ingestion (*food, dish, pizza*), Leisure (*ball, playstation, party*), Friend (*friend, bf, bud*), Health (*clinic, flu, pill*), Body (*cheek, hands, spit*), Swearing, and Non-dictionary words (slang and acronyms). For each dictionary, we counted the number of posts with a term from that dictionary, and compared the two groups (parents writing to children and parents writing to friends). Because we make multiple comparisons, we only accept differences that are significant in a χ^2 test at least at the $p < 10^{-5}$ level, and where the relative difference between the two groups is at least 5%. Figure 7 shows the results in four parts. The top part shows that parents use 31.3% more terms in the Family category when speaking to their children than to their other friends $\chi^2(1, N=100{,}000)= 4871.8$, $p = 10^{-16}$. (All further tests are similar in magnitude and significance, so are omitted.) Similarly, parents use 11.7% more Social and 9.1% more Affect words with their kids. (Note that the Social category encompasses Family, but also includes references to calling and visiting, so Family is shown separately.) Dictionaries that were not significantly different were omitted from the figure.

To summarize, parent-child communication on Facebook generally looks like you would expect: it's full of affection, advice, phone calls, and grandchildren. Next, we delve into differences related to age and gender.

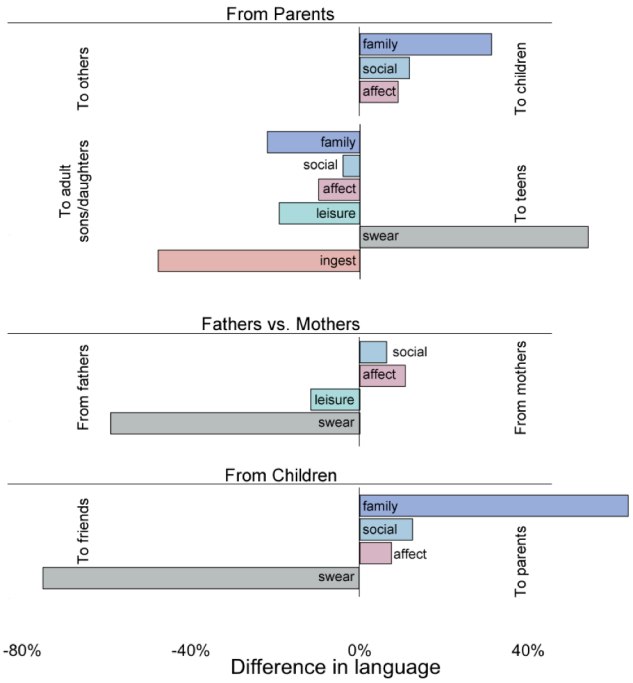

Figure 7. Difference in language use between groups for LIWC categories. Parents use more family, social, and affect terms when writing to their children than to their friends. They swear more when talking to their teens. Fathers swear more and discuss leisure activities, while mothers use more social and affect terms. Children use more social, family, and affect words with their parents, and swear more with friends. (All $p < 10^{-5}$.)

Parents to Teens versus Adult Children

Now we examine how parents talk to children at different life stages. Using the same regression techniques, we now predict whether the recipient is a teen (ages 13-17) or an adult child (age 30+). Tables 2 and 3 shows the resulting terms. Toward adult daughters and sons, parents express effort surrounding keeping in touch (*updates, get together*) and bring up health (*speedy recovery, healing, medicine, heals*), a topic that might either be reflective of parents of adult children being older themselves and having more health problems, or that parents of teens talk about physical health in person rather than on Facebook. Food is a common theme among parents talking to their teens, reflecting that most teens live at home and share meals with their families (*baked, supper, cereal, soup, dinner*). These meal terms are not predictive of posts to adult children who have generally moved away, though the LIWC analysis suggests food is actually mentioned in higher percentages with adult children (Figure 7). An informal analysis of the most common food words in the two groups finds "fat" and "pizza" to be ranked disproportionately highly among conversations with teens, and "thanksgiving," "turkey," and "wine" among the adults, suggesting that the data collection in the three months surrounding

Parents to their teens (vs. their adult children)

Phrase	Odds	Phrase	Odds	Phrase	Odds	Phrase	Odds	Phrase	Odds
baked	4.39	on your way	2.32	i taught	2.01	looked so	1.88	send him	1.77
mommie	3.29	who loves	2.29	honey	2.01	today love	1.88	wish i was	1.77
looking couple	3.16	are so funny	2.27	maddy	2.01	me too lol	1.86	have gone	1.77
babygirl	3.06	lo que	2.27	ill do	2.01	amor	1.86	expecting	1.77
love mom	3.06	one way	2.25	bubba	1.99	of days	1.84	peanut	1.77
te amo	3.00	daughter	2.25	grandson	1.97	costumes	1.84	looks like your	1.77
check this	2.92	gamers	2.25	thats my	1.97	these pictures	1.84	ask if	1.75
first of	2.89	knows how	2.23	compared to	1.97	good pic	1.82	just never	1.75
grammy	2.77	limit	2.20	appropriate	1.95	my life i	1.82	very lucky	1.75
great game	2.66	good boy	2.20	like fun	1.95	happy <number> th	1.82	tongue	1.75
going there	2.66	my gorgeous	2.16	your mind	1.95	go shopping	1.82	background	1.75
terms	2.64	my handsome	2.16	http apps	1.93	cereal	1.80	good to me	1.73
supper	2.59	she isnt	2.12	http apps facebook	1.93	mimi	1.80	exercise	1.73
grandma is	2.53	cute in	2.12	your mama	1.93	thanks baby	1.79	loves you	1.73
copy of this	2.48	love the pictures	2.10	thats because	1.92	bug	1.79	this world	1.73
your room	2.39	i ♥ u	2.10	baby girl	1.90	someone i	1.79	about now	1.73
dad	2.39	carry on	2.08	my sweet	1.88	your friends	1.79	love him so	1.72
papa	2.39	you really are	2.08	me proud	1.88	have something to	1.79	two of my	1.72
son	2.34	to close	2.08	your list	1.88	that is great	1.79	thats my girl	1.72
mija	2.32	few minutes	2.05	what r	1.88	your homework	1.79	grounded	1.70

Table 2. The top phrases associated with parents writing to their teens (ages 13-17), compared to writing to their adult children (age 30+).

Parents to their adult children (age 30+, vs. to their teens)

Phrase	Odds	Phrase	Odds	Phrase	Odds	Phrase	Odds	Phrase	Odds
your son	4.31	figures	2.34	link to	2.03	we can go	1.84	say they	1.75
titi	3.35	i totally	2.32	maroon	2.03	walking around	1.84	comes out	1.75
cousin	3.13	gota	2.29	selling	2.03	on youtube	1.82	i am also	1.73
prima	3.03	my friend	2.29	bro	2.01	fuck	1.82	in charge	1.73
one person	2.86	division	2.27	such a cutie	1.99	you though	1.80	should come	1.73
much love to	2.72	update	2.25	mom and dad	1.99	my kids	1.80	something like this	1.72
my dad	2.56	ctfu	2.23	cheat	1.97	sexy	1.80	lol thanks	1.72
cuzzo	2.53	look wonderful	2.23	no problem	1.97	healing	1.80	i cant find	1.72
just a few	2.53	foster	2.23	fucked	1.95	love their	1.79	idk	1.72
your daughter	2.46	hear about your	2.20	well what	1.95	updates	1.79	awesome i	1.72
familia	2.44	finest	2.20	chica	1.92	if you go	1.79	lol my	1.72
es el	2.44	yeah it	2.20	omfg	1.90	bunch of	1.79	deserved	1.72
ugh i	2.41	look so happy	2.14	cuando	1.90	i play	1.79	well for	1.70
speedy recovery	2.41	lmao	2.12	im ok	1.90	admin	1.77	be well	1.70
be proud of	2.41	bueno	2.10	so much i	1.90	miss this	1.77	medicine	1.68
its cool	2.41	niece	2.10	lmfao	1.88	dummy	1.77	right now i	1.68
thx	2.39	balls	2.10	as i said	1.88	recommend	1.75	people need	1.68
my mom	2.39	nephew	2.08	sis	1.86	c mon	1.75	ma am	1.68
moving to	2.36	wifey	2.05	got a new	1.84	you girl	1.75	congrats to you	1.68
tequila	2.34	thus	2.03	coming from	1.84	rocky	1.75	condolences	1.68

Table 3. The top phrases associated with parents writing to their adult children (ages 30+), compared to writing to their teens (13-17).

Thanksgiving may account for the differences between LIWC and the regression on food as a topic.

Parents also make small linguistic shifts in possessives with their adult children that are similar to their conversations with other adult friends: they refer to their child's grandparent as *my mom* or *my dad*. They also use more slang (*ctfu, lmao, omfg)*. Parents appear to be treating their adult daughters and sons more like peers. The LIWC analysis (Figure 7) reveals that parents also generally use more Family, Social, and Leisure words when their children are grown, possibly talking about grandchildren, as well as vacations, daily life, and activities, topics that might just be discussed at home with teens. With their teens, parents are more likely to swear, possibly in an attempt to fit in stylistically with how teens write (an informal analysis finds that teens generally swear and use more slang than adults on Facebook). However, variants of *fuck* are more predictive of conversations with adult children (Table 3), suggesting that parents may use the softer swear words with their teens. Parents also use diminutives with their teens (see Table 2): *babygirl, my baby, kiddo, my little* and discuss their teen's appearance (*my gorgeous, my handsome, cute in, looking couple, looked so)*, particularly in photos (*love the picture, these pictures, good pic*) more so than they do with adult children. Though it might seem more likely that parents would discuss photos with their adult children, especially photos of grandkids, these predictive terms suggest that the parents are nurturing their teens by telling them they're beautiful, and might also indicate that teens

appear in more photos on which their parents can comment.

In summary, parents speak very differently with their adult children, talking about medical issues and other family members, and their style sounds more like a peer, whereas parents nurture and compliment their teens.

Mothers vs. Fathers, Daughters vs. Sons

Consistent with literature on communication differences between men and women, on Facebook, mothers express more emotional support and fathers talk about specific facts and objects (Block 1983). Mothers' posts are more emotional: *xoxo, so sorry, poor baby, worried, so proud of, tears, tired* while fathers' support appears more abstract: *everything will, no pain, keep it up, got your back*. Fathers are more likely to discuss shared interests, such as politics (*gop, romney is, democrats, government, voting for, election, republican*), sports and games (*xbox, sports, golf, steelers, can play, playing in, handed, offense, court, game*), and music (*tune, bands*). The LIWC analysis (Figure 7) confirms these differences.

Both parents are more likely to use affection toward their daughters: *honey, sweetheart, babygirl, pumpkin*, rather than their sons (*my boy, you son*), and mothers' language is more social with their daughters, referring to other family members (*son in law, my dad, our family*). As in offline communication (Block 1983), parents appear to push their sons toward independence (*interview, hiring, go to work*, *haircut*).

Talking to Parents on Facebook

Now, we look at the phrases predictive of Facebook users writing to their parents. The strongest clues are simply ways of addressing parents (*mom, dad, mommy, momma, madre, pops*), while the opposite case (users addressing their friends) includes references to friendship (*dear friend, our friendship, bestie*) or addresses to specific other family members or spouses (*cuzzo, you boo, you too baby, prima, love you aunt, you brother*). Children also talk about calling their parents (*answer your phone, calling you, you call me*), and to a lesser degree, visiting (*right over, we should go*). While referencing calling and visiting is generally predictive of family communication, it's more likely to be coming from the parent rather than the child. Virtual laughter is also more predictive of posts written to parents (*lol, xDDD, hehehehe)*. One interpretation is that commenting with laughter is simply a lightweight way to indicate that you've seen a post. People are much more likely to swear when talking to a friend than a parent (*effing, i fucking love, pissing me*) and use slang (*smfh, lmfaoooo, ctfu*). People also reference private messages (*pm you, pm me, you a pm*) more often with friends than parents. It may be the case that private conversation with parents shifts to the phone or face-to-face, while private Facebook messages are the channel of choice for other relationships. The LIWC analysis (Figure 7) confirms that children use more Family, Social, and Affect words with their parents (as parents do with their kids), and save Swearing terms for their friends, not mom and dad.

General Discussion

Overall, we see evidence that parent-child relationships on Facebook look much like they do offline. Children's communication with their parents decreases throughout their teens as they seek independence, and rises again when they leave the house. In contrast to previous research, we find that communication frequency on Facebook does not diminish with geographic distance, suggesting that the site may facilitate extended family communication. When both parties are already regularly using the site, it takes little additional effort to comment or check in with the other person. Parents and their children are surrounded by mutual friends, including relatives and peers of the child and parents. In some cases, these mutual friends span three generations, when teens, their parents, and their grandparents are all Facebook friends. Parents initiate a lot of conversations, particularly when their daughters are raising families of their own. Their posts to each other are full of affection, and we see parents treating their grown-up children as the adults that they are. Mothers do most of the talking.

All of the present conversations were held semi-publicly: Timeline posts and comments are typically visible to friends of the parent and child, depending on privacy settings. One open question is whether the observed communication patterns are simply a performance, with parents and children acting in ways that are expected of them (Goffman 1959). Parents of teens want their presence to be known among the child's peers to tacitly enforce good behavior (Lenhardt et al. 2011), so they comment on photos and swear occasionally to fit in. Parent-child communication may be very different in private, with more intimate disclosure, complaining, or nagging. Or, parents and children may simply use other channels for private conversation, such as the phone, email, or talking in person. Understanding differences between public and private conversation is left to future work.

One limitation of this work is that we do not know about unreported family relationships and cases where one party is not on Facebook. In these cases, either the parent or the child might be an infrequent user or less tech savvy, doesn't want Facebook to have information about family connections, or doesn't want to be connected to the other. Pew reports that 53% of parent-teen dyads are Facebook friends (when both parties use the site, Madden et al.

2012), and so our finding that 40% of teens have friended and marked a parent as such suggests that we are capturing the majority of relationships. However, we know little about coverage of older parents and adult children, or how friending a parent might differ with ethnicity or socioeconomic status.

Conclusion

This work presents a quantitative examination of an important phenomenon in social media: a confluence of social media users, their parents, and their children on the same site. Our language models can be applied to identify parent-child relationships among unlabeled ties. Phrases like *love dad* are highly informative and can help distinguish between, say, a father and an uncle. These inferred relationships can be used to prioritize news stories, recommend friend connections with other family members, or automatically generate lists for privacy settings. This convergence of family members on Facebook has only occurred in the last few years, and so it's important to document the state of these relationships, and to lay the groundwork for future studies on privacy, sharing, and major life events.

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References

boyd, d. 2008. *Taken out of context: American teen sociality in networked publics.* PhD Dissertation, University of California Berkeley.

Block, J. 1983 Differential premises arising from differential socialization of the sexes: Some conjectures. *Child Development* 54: 1335-1354.

Brown, P., & Levinson, S. 1987. *Politeness: Some universals in language usage*. Cambridge University Press.

Cao, X., Sellen, A., Brush, A. J., Kirk, D., Edge, D., & Ding, X. 2010. Understanding family communication across time zones. In *Proceedings of the 2010 ACM conference on Computer supported cooperative work*, 155-158. ACM.

Dubas, J. & Petersen, A. 2006. Geographical distance from parents and adjustment during adolescence and young adulthood. *New Directions for Child and Adolescent Development,* 3-19.

Fitzpatrick, M. & Marshall, L. 1996.The effect of family communication environments on children's social behavior during middle childhood. *Communication Research*, 23(4) 379

Fitzpatrick, M.. & Vangelisti, A. 1995. *Explaining Family Interactions.* Thousand Oaks, CA: SAGE

Friedman, J., Hastie, T., and Tibshirani, R. 2010. Regularization paths for generalized linear models via coordinate descent. *Journal of Statistical Software*, 33(1): 1-22.

Garner, P., Robertson, S., & Smith, G. 1997. Preschool children's emotional expressions with peers: The roles of gender and emotion socialization. *Sex Roles*, 36(11-12), 675-691.

Gilbert, E. 2012. Phrases that signal workplace hierarchy. In *Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work,* 1037-1046. ACM Press.

Goffman, E. 1959. *The presentation of self in everyday life.* Garden City, NY.

Kanter, M., Afifi, T., & Robbins, S. 2012. The Impact of Parents "Friending" Their Young Adult Child on Facebook on Perceptions of Parental Privacy Invasions and Parent–Child Relationship Quality. *Journal of Communication*, 62(5), 900-917.

Lawton, L., & Silverstein, M. 1994. Affection, Social Contact, and Geographic Distance Between Adult Children and Their Parents. *Journal of Marriage & Family*, 56(1), 57-68

Lye, Diane N. (1996) Adult child-parent relationships. *Annual Review of Sociology* 22, 79-102

Madden, M., Cortesi, S., Gasser, U., Lenhart, A., Duggan, M. (2012). *Parents, Teens, and Online Privacy*. Pew Internet and American Life Project. http://www.pewinternet.org/Reports/2012/Teens-and-Privacy.aspx

Mesch, G. S. (2006). Family relations and the Internet: Exploring a family boundaries approach. The Journal of Family Communication, 6(2), 119-138.

Pennebaker, J. W., Francis, M. E., & Booth, R. J. 2001. *Linguistic inquiry and word count: LIWC 2001.* Mahway: Lawrence Erlbaum Associates.

Rosen, Larry D., Nancy A. Cheever, and L. Mark Carrier. 2008. The association of parenting style and child age with parental limit setting and adolescent MySpace behavior. *Journal of Applied Developmental Psychology* 29(6). 459-471.

Silverstein, M., Parrott, T. & Bengtson, V. 1995. Factors that predispose middle-aged sons and daughters to provide social support to older parents. *Journal of Marriage & Family*, 57(2), 465-475.

Spitze, G., & Logan, J. 1990. Sons, Daughters, and Intergenerational Social Support. *Journal of Marriage & Family*, 52(2), 420-430

Stewart, Cooper, Stewart & Friedly. 1996. *Communication and Gender* (3rd Ed.) Scottsdale, AZ: Gorsuch Scarisbrick.

Subrahmanyam, K., & Greenfield, P. (2008). Online communication and adolescent relationships. *The Future of Children*, 18(1), 119-146.

Tee, K., Brush, A. J., & Inkpen, K. M. 2009. Exploring communication and sharing between extended families. *International Journal of Human-Computer Studies*, 67(2), 128-138.

Umberson, D. 1992. Relationships between Adult Children and Their parents: psychological consequences for both generations. *Journal of Marriage and Family* 54, (3), 664-674.

Westermann, D. 2011. Mom, Dad, Let's Be (Facebook) Friends: Exploring Parent/Child Facebook Interaction from a Communication Privacy Management Perspective. MA diss., Kent State University.