Online Exogamy Reconsidered: Estimating the Internet's Effects on Racial, Educational, Religious, Political and Age Assortative Mating

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Abstract

Increases in the rates of interracial and interreligious couples within the U.S. have occurred seemingly in tandem with the rise of the Internet and online dating, but the evidence connecting online sources of romance and couple heterogeneity have been limited and mixed. Using a unique dataset collected in 2009 and again in 2017 on how U.S. couples met, and controlling for the diversity of their local geographies, I find that couples who met online are more likely to be interracial, interreligious, and of different college degree status, but also more similar in age. These differences can vary by where on the Internet couples met, with online dating websites and apps showing a clear effect on increased age assortativity, while other online sources of partners do not. Population-level estimates suggests that only a small part of the recent changes in couple diversity can be directly attributed to couples meeting online, but there is the potential for more Internet-induced change if it becomes the primary source of romantic introductions.

The potential for the Internet to drastically change the structure of social relationships seems profound, yet the social impact of technological transformations can often be underwhelming, with stratification and social boundaries largely reproduced across technological epochs. A seemingly very straightforward and direct way that the Internet

is altering social relationships is through online dating, the creation of new couples from strangers who otherwise may never have had the opportunity to meet one another. Now that Internet sources account for over a fifth of new U.S. couples, and most new same sex couples (Rosenfeld and Thomas 2012), the structure of online romantic interactions is of growing importance in determining the kinds of couples and families that are formed within the U.S. If the Internet is bringing together people from different social groups and class positions, resulting in more families that blend together multiple groups, then those social boundaries could be substantially weakened in a world of increasing online dating. However, it's also quite possible that the ways people meet online actually reinforce some group boundaries, creating more homogenous couples and families than would result otherwise.

What we know about the diversity of couples that result from meeting online has so far been very limited. National probability samples that both include data on how couples met and are recent enough to capture the rise of online dating have been very rare: studies using one survey of the U.S. (Potarca 2017; Rosenfeld and Thomas 2012) and one of Germany (Potarca 2017) found mixed results on the impact of the Internet on couple assortativity. Both found that couples who met online had greater odds of being interreligious, but otherwise found that, controlling for other factors, online meetings differed only from specific offline settings that are exceptionally segregated on a social dimension: Potarca (2017:295) found that online dating is related to less educational endogamy than are school-formed romances in both countries, and related to less racial endogamy than meeting through family members in Germany. Using non-probability

samples from opt-in online survey panels, Dutton et al. (2009) found that couples in Spain and the UK who met online were more dissimilar in age and education than those who found each other offline. None of these previous studies controlled for the diversity of the cities and neighborhoods the respondents were embedded within, however, which is a potentially major confounding factor in determining couple composition.

Evidence from profiles and messaging within online dating websites has been more plentiful (Hitsch et al. 2010; Huber and Malhrota 2017; Lewis 2016; Lin and Lundquist 2013; Robnett and Feliciano 2011; Skopek et al. 2011), but this kind of evidence only offers a limited window into an early phase of couple formation, within specific websites. While these have consistently shown that online interactions are segregated by most social dimensions, it is not clear that the extent is greater or less than what occurs in offline romantic markets. This evidence also doesn't connect online interaction patterns to the couples that result (one exception is Lee's [2015] study of an online dating website in South Korea, which found increased age and educational endogamy in the resulting marriages, but less occupational endogamy). Assortativity can change significantly between different stages in online relationship progression (Bruch et al. 2016), and it is reasonable to assume it likewise can change in the transition to offline stages of romance. And while online dating websites and apps are the most common way couples meet online, a significant proportion of couples find each other through other online sources (Rosenfeld and Thomas 2012), which likely have very different interaction patterns within them. While studies that only look at online dating interactions do shed light on

important processes behind couple formation, they can't really tell us about the Internet's effects on the endogamy of couples in a population.

This is the first nationally representative study of couples to examine differences between couples who meet online and offline controlling for the diversity of their local geography, as well as the first to demonstrate a general and robust effect of online dating on the racial, educational and age composition of the couples that result, compared to all other couples. I also offer here estimates of the population changes in exogamy from meeting online, which has largely been a matter of speculation.

The Internet's Potential to Break Down Group Boundaries

The initial and perhaps greatest barrier to the creation of diverse couples is the lack of opportunities for contact between people from different groups. If the spaces, groups and networks through which people find their romantic partners are already highly segregated on a social dimension, then the resulting couples will also tend to be highly segregated on that dimension, regardless of other factors (Blau, Blum and Schwarz 1982; Feld 1982). Early-to-mid 20th century U.S. marriages typically occurred between those who lived within the same or nearby neighborhoods (Bossard 1932), and couple endogamy mirrored residential segregation. In the mid-to-late 20th century U.S., introductions through friends was the most common source of marriages (Rosenfeld and Thomas 2012), creating couples that represented the homogeneity of friendship networks. Interactions online, on the other hand, can potentially occur between any two people who share a common

language. While some dating websites are organized around ethnic and cultural niches, the vast majority of online dating occurs in general audience and openly-accessible apps and websites (Smith and Duggan 2013). Even the chat rooms, online organizations and games that friendships and romances begin within have far fewer barriers to entry than offline groups and voluntary organizations. Internet spaces for meeting new people are radically less exclusive than traditional sources of romance. This expands both the scope and the diversity of the local market for mates that people interact with, and reduces the involvement of family and friends in screening potential partners (i.e. third party interference) (Kalmijn 1998).

The Potential for the Internet to Reinforce Group Boundaries

There are also reasons to suspect that the Internet may actually increase romantic assortativity, beyond just reproducing the patterns in offline couplings. Communication is easier and more likely to occur when there is shared cultural content (Carley 1991). Cultural differences are correlated with a number of other social distinctions, such that sorting on cultural similarity also tends to produce sorting on race, ethnicity, social class, religion, etc., to varying degrees (Blau 1977; Stark and Flache 2012). While this process can occur in any communication medium, online interfaces and structures may heighten cultural homophily.

By design, online dating is an exercise in cultural homophily. The profile options of many dating websites and apps encourage the listing of activities and consumptions that

the daters like and dislike, which explicitly signals their specific positions within the larger cultural space (Mark 1998). Even when apps and websites don't explicitly prompt for that, the presentation of self through the construction of profiles and the framing and selection of images conveys a wealth of cultural information about the online dater (Rudder 2014). Furthering heightening assortativity by culture, online dating may foster a shopping mentality in sizing up potential mates (Heino et al. 2010), encouraging a check-list approach to sorting prospects, augmenting discriminatory preferences that would otherwise be weaker and more easily overcome by other personal characteristics in face to face interaction.

Couples who find each other online, but not through online dating, tend to do so through online communities, chat rooms, games and social networking websites like Myspace and Facebook (Rosenfeld and Thomas 2012). Online games and communities are voluntary organizations much like their offline counterparts, selected on shared cultural interests, and may exhibit similar segregation by gender, social class and race (McPherson and Smith-Lovin 1987). Chat rooms can likewise function as interest-focused communities, though they can also be very open public spaces that facilitate general social interaction between strangers. Social network apps/websites, by contrast, are loose reflections of the user's offline social ties, though sometimes more expansive. Online extensions of offline networks may help broker new ties, but these connections may be expected to still reflect the homogeneity of those offline social circles. Communication in online communities and through social network websites has been shown to be highly segregated by political

ideology (Adamic and Glance 2005) and other cultural factors (Lewis et al. 2008), as well as by race and ethnicity (Wimmer and Lewis 2010).

Self-selection into online spaces can determine the degree of segregated interaction between online venues, but the interface(s) through which users interact and perceive each other can affect segregation within venues. In some online spaces, demographic characteristics of the users are predominantly featured, but in others they are obscured and underemphasized. Users of an online game may spend many hours together without guessing each other's ethnicity or education levels, but online dating profiles typically display this information front and center. The assumed intentions behind most user interactions may also influence the assortativity of the ties that result. When romance is the explicit goal of an online space, interactions are perceived through that lens from the onset, which can heighten a shopping mentality for desired mate attributes (Heino et al. 2010). When other activities are the focus, friendship can come first, and people can later be surprised by an emerging romance.

Larger and more diverse dating pools may also counter-intuitively lead to greater segregation. By increasing the freedom of choice, they can reduce structural constraints limiting homophily biases from being enacted. Larger and more diverse schools tend to exhibit greater racial friendship segregation than smaller schools, for instance, as students' choices are more constrained by availability in small friendship pools (Moody 2001). When social dimensions are not correlated (i.e. intersecting), diverse relationships are more likely in part because a homophily bias on one dimension can conflict with a bias on another dimension (Blau 1977). Occupational endogamy and racial endogamy

can conflict in a small dating market where occupations are racially integrated, such that selecting on one dimension makes it more difficult to also satisfy the other bias. By expanding the size of dating markets, online dating can have the unintended consequence of making it easier for daters to satisfy all of their various homophily preferences, by increasingly the likelihood that they find that very specific combination of traits that match themselves.

The above arguments represent competing visions of the Internet, one as a more open and diverse space freed from the physical and hierarchical social boundaries of the offline world, and the other as a highly Balkanized place in which users self-sort into echo-chambers of similarly minded others. The reality of the Internet is a mix of these characterizations, but it is not entirely clear *a priori* which aspect should have a stronger effect on the kinds of couples that find each other online.

Data and Methods

The How Couples Meet and Stay Together survey (HCMST) (Rosenfeld, Thomas, and Falcon 2015) was gathered using GfK/Knowledge Networks' (GfK/KN) panel of respondents, with an initial sample surveyed in 2009, five follow-up waves with those same respondents over the next several years, and then a second sample of new respondents in 2017. My analyses here focus on the initial wave in 2009 and the new sample in 2017 (the only waves that included information on how couples met and their

partners' characteristics). GfK/KN altered its sampling method for new panel members between these sample years: the 2009 subjects were selected for recruitment into the panel by a random digit dial of phone numbers in the 50 U.S. states and Washington D.C, while subjects in 2017 were selected by address-based sampling. Both were aggressively recruited with follow-up phone calls and certified mail. The GfK/KN panel consisted of over 40,000 members in 2009 and over 55,000 in 2017, of which 4,002 and 3,510 were included in the HCMST study, respectively, with response rates of 71% and 50%. When thinking of the response rate as a cumulative process through all of the steps from the initial recruitment into the panel, to attrition within the panel, to screening for and then completion of the HCMST survey, then the cumulative rate would only be in the teens. However, such a rate isn't directly comparable to traditional surveys, as KN partially controls for potential attrition bias by using demographic information collected at each survey stage (Couper 2000). KN panel surveys have been shown to perform better than traditional random-digit-dial samples (Baker et al. 2010, p. 743; Chang & Krosnick 2009; Fricker et al. 2005), and are used by a number of prominent social science research data collection projects, such as the American National Election Survey (2017).

Both samples only cover the U.S. English-speaking population of the 50 states and Washington D.C. Surveys were conducted through a web interface, and GfK/KN provided the necessary equipment and Internet access to those who did not already have home access, through television set-top devices at the time of the 2009 survey, and through tablet computers by the time of the 2017 survey. Panel members received 3-4 surveys a month, requiring an average of 15 minutes to complete, which they could finish

piecemeal over the course of a week.

Sampling Couples

From the initial samples of 4,002 and 3,510 respondents (in 2009 and 2017 respectively), the survey asked if they were currently in a relationship, of which 3,009 and 2,862 responded that they were. The 993 un-partnered respondents in 2009 were not asked any further questions, and are not included in the analyses here. The 648 un-partnered respondents in 2017 were instead asked about their most recent relationship, of which 541 reported that they had such a relationship. To account for differences between current versus retrospective relationship sampling, I control for both whether the couple was still together at the time of the survey, as well as the duration of the relationship in years, which is the time since relationship onset for current couples. I limit the analyses here to only couples who met after 1995, to ensure comparisons between offline- and online-formed couples are only within the era that Internet usage was at least somewhat common. This reduces the sample of couples to 3,036. This sample includes a purposive oversampling of same sex couples, so I include a binary indicator of same sex composition in all analyses, as well as survey weights that account for the oversample. Analyses without same sex couples produced very similar results. See Table 1 for sample means and proportions of all of the variables described below.

Detecting Internet-Created Couples

I use two approaches towards classifying couples as those who met online versus not. The first is a simple dichotomy of those who indicate any role of the Internet in their first

meeting versus those who do not. The second is a more detailed classification that compares those who met strictly online as otherwise-strangers to both those who met purely offline and those who met through a combination of online and offline connections. This second classification scheme also breaks down the strictly online meetings into websites and phone apps specifically designed for finding partners versus all other online spaces.

The HCMST data contains highly detailed information about how couples first met, uniquely so for a national sample. The survey included an open-ended question asking respondents to tell their story in detail:

> Please write the story of how you and [Partner_Name] first met and got to know one another and be sure to describe "how" and "where" you first met.

This was followed by a large text box, and the web interface prompted respondents to add more after their initial submission (regardless of how much they wrote), also prompting them a second time if their story was less than 100 characters. The median story was 185 characters long, with 75% longer than 100 characters and 25% longer than 353 characters. The first wave of these stories was open-coded by two of the data authors to determine non-mutually-exclusive categories of how the couples met, and then coded using these categories by the authors and an additional research assistant, with a high degree of inter-coder reliability. The second wave of the data was coded by a research assistant according to the categories from the first wave. I additionally read and coded the stories of all respondents who identified an online meeting in the multiple choice question or by the existing story coding, for my more detailed classification.

After telling their story, the respondents were asked a series of multiple choice questions about their first meeting with their partner. This included the following question about the role of the Internet in their meeting, and the kind of online venue they met it:

Did you use an Internet service to meet [Partner_Name]?

No, I did NOT meet [Partner_Name] through the Internet
Yes, a social networking site (like Facebook or Myspace)
Yes, an Internet dating or matchmaking site (like eHarmony or match.com)
Yes, an Internet classified advertising site (like Craigslist)
Yes, an Internet chat room
Yes, an app on my phone (like Tinder or Grindr) [2017 sample only]
Yes, a different kind of Internet service

If there was any indication of an online meeting in either the respondent's answer to this question or in their open-ended story, I classified the couple as having met online in the first, more inclusive measure of Internet-created couples, following Rosenfeld and Thomas (2012).

To distinguish between couples that met as strangers online and those that met through a combination of online and offline introductions, I first use two questions in the HCMST that identify prior social network/context overlap (Kalmijn and Flap 2001). The first of these asked whether the respondent's parents and their partner's parents knew each other before they first met, and the second asked whether they had friends in common, or their friends knew each other, before meeting each other. The survey also asked whether they attended the same high school, college, and/or grew up in the same town. While these also may often be a good indicator of prior offline social network overlap, this is highly dependent on the size of those units, which is unknown, so I don't use school and town

overlap here. If a respondent classified as having met online also identified prior family or friend overlap in these questions, I code that couple as having met through a combination of online and offline sources. I additionally re-read the meeting stories of all respondents who were coded as having met online above, and code respondents as having met their partner both online and offline that identified any offline brokerage in their story. This results in a high bar of classifying couples as Internet-created, meant to identify previously unconnected strangers who found each other only through the Internet, and would likely have never met otherwise.

I further break down this met-strictly-online category into those who identified having met through a dating website or phone app (either in their multiple choice answer or in their story) and all other strictly-online meetings. This results in four categories of couple-formation: purely offline-formed couples, purely online-formed couples who met through an Internet dating site or phone app, purely online-formed couples who met in another (or unidentified) Internet venue, as well as couples who met through a combination of online and offline sources. This last on/offline hybrid category includes couples who knew each other in a previous life stage, lost touch, and then reconnected through a dating website, social network site, etc. It also includes couples who met friends-of-friends through social networking sites, their initial communication purely online but the shared context that connected them largely offline. The Other Internet category includes a wide variety of online venues such as chat rooms, online games, online organizations and interest-oriented online communities, and unspecified online meetings.

Measuring Couple Characteristics

Race and Ethnicity. The HCMST survey asked about respondents' partners' race and Hispanic ethnicity separately, which I combined into a single scale that codes all Hispanic partners into that category, and also includes White, Black, Asian/Pacific-Islander, and Other. Respondents had already answered a similar set of questions about themselves for the GfK/KN panel demographic survey, which I recoded into the same categories. Respondents could identify themselves as multiple races: I coded anyone who identified as Hispanic into that category, and anyone who identified as Black but not Hispanic into the Black category, and all other multiracial respondents into the Other category. Couples are coded as different race/ethnicity based on these categories. As a robustness check, I replicated the findings below with alternate coding schemes, such as coding all multiracial as others, or treating multiracial Asians as Asian, or even ignoring Hispanic ethnicity entirely, and found very similar results to those presented here.

Education: Respondent's, Partner's and Mothers'. Education was measured on a 14 point scale for both the respondent (in the Gfk/KN panel survey) and the respondent's partner, as well as for both the respondent's and partner's mothers, as reported by the respondent. This scale asked for the highest grade or degree completed, including no formal education, 1^{st}-4^{th} grade, 5^{th}-6^{th} grade, 7^{th}-8^{th} grade, 9^{th} grade, 10^{th} grade, 11^{th} grade, 12^{th} grade without a diploma, high school diploma or equivalent, associate's degree, bachelor's degree, master's degree, and professional or doctorate degree. I use a dichotomized indicator of college graduate status in the analyses below. Note that there are no significant differences between online and offline-formed couples in the absolute

value differences of these full scales, whether comparing respondents' and partners' or their mothers' education levels.

Religion. The 2009 HCMST survey included questions about the respondent's partner's religious identity, and both the respondent's and partner's identity at age 16, but the 2017 survey did not. These were modeled on a GfK/KN panel question that was previously asked of all respondents. The response options were Baptist, Other Protestant, Catholic, Mormon, Jewish, Muslim, Hindu, Buddhist, Pentecostal, Eastern Orthodox, Other Christian, Other Non-Christian, and None. I recoded these into a 4 category scheme: Catholic, Protestant/Other Christian, Other Religion, and None. I replicated the analyses below using the original 13 categories, which produced only minor differences in the results. Similar results are also found when examining exogamy by religious identity at age 16 instead of current identity.

Politics, Age and Controls. Both surveys included information about the respondent's partner's political identification. As the scales were different between the two surveys, I simplify both to three categories here: Republican, Democrat and Other. I also examine age assortativity below, operationalized as the absolute age difference in years between partner and respondent, from both samples. I include additional covariates in the multivariate models to control for potentially confounding factors, including the duration of the relationship, when the couple first met, whether the couple was married, coresidency, the respondent's and couple's gender, respondent's household income scale, the number of children in the respondent's household, and the region the respondent lived in at the time of the survey.

Local Diversity Measures

A major threat of spuriousness to any claim of the Internet's effect on exogamy lies in the potential differences in the diversity of places where online dating is popular versus the places where people less often find romance online. If people in more diverse urban areas are more likely to find long term partners online, for instance, then it could spuriously appear that the Internet is creating more heterogeneous couples, even if couples within the same geographic units are on average no different if they meet online versus offline. Despite this concern, this is the first study to compare online and offline endogamy that controls for the local diversity the respondents are embedded within.

I use two different geographic identifiers from the HCMST data: where the respondent lived at the time they met their partner, and where the respondent lived at the time of the survey. The first directly and clearly reflects the demographics of the local opportunities for mates that the respondent was embedded in at the time they found their partner, but has two major drawbacks. First, the measurement is based on the respondent naming the place they lived, and thus can only be matched to metro/micro-politan areas or counties rather than more precise local geographic units. The second drawback is that this question was only asked of the 2017 sample, which both limits the N of the analyses that use it and precludes its use in the religious exogamy analyses, which is only possible with the 2009 data. Gfk/KN collected the zip codes of respondents at the time of both surveys, which allows for more specific measures of racial and educational diversity in additional to MSA level measures, as well as the inclusion of the 2009 cases in the analyses. Segregation tends to be recreated across geographic relocations (Sampson and Sharkey

2008), such that current local area diversity is typically a good proxy for the diversity that people were exposed to in the past as well. I'll test this assumption in the results below, but most tables and models will use data about the respondents' location when surveyed.

I matched respondents to information about their current zip code and their current and past metro/micro-politan area (MSA). Some rural respondents' zip codes and places they previously lived were not within an MSA, so I include information about their county instead. Some respondent's lived in zip codes that could be matched to multiple MSAs or counties; for these I calculated a weighted average of the MSA/county measures by the distribution of their zip code between them, as apportioned by the MABLE/Geocorr12 Geographic Correspondence Engine (Missouri Census Data Center 2012).

Diversity can be measured in a number of different ways. For race, religion and college degree diversity, I simply control for the proportion of the geographic unit of the same group as the respondent. This ego-centric way of coding diversity is the most directly determinant of the dependent variables in the analyses: whether the respondents matched with a partner different from themselves. I don't have data on proportions of political party identification in these geographic areas, so I use a partisan voting scale instead (see below).

I use data from the Decennial Census in 2000 and the American Community Survey's (ACS) 5-year estimates in 2010 and 2015 (United States Census Bureau 2015), to measure the racial/ethnic, educational and income composition of the respondent's zip codes and their larger metro-/micro-politan area (MSA). The year of the survey or the

year the couple met determines which of these three sources is used, such that the greatest temporal mismatch is no more than five years (e.g. a 2005 meeting matched to the 2010 ACS data). The models below control for the proportion of the respondent's zip code and MSA/county that are the same racial category and same college graduate status as the respondent. The race/ethnicity measures use the ACS's reported categories, which treat Hispanic as a separate non-racial category, and only separate out non-Hispanic respondents for one racial category, White. This yields 7 categories: White Non-Hispanic, Hispanic, Black, Asian, Pacific Islander, Native American, Other, and Multiracial. Despite the double counting of many non-White Hispanics, these are nonetheless good indicators of the proportion of people in respondent's local areas that identify as the same category as themselves.

I measure the respondents' local political context using Cook's Partisan Voting Index (Wasserman and Flinn 2017) for their congressional district (or Washington D.C.). I match respondents' zip codes to congressional districts for their location when surveyed, but I match their MSA to congressional districts for their location when they met their partner, averaged for places in multiple districts weighted by the districts' geographic share of the places. As this measures voting in previous elections, I use the closest PVI moving forward in time. For instance, for the 2009 sample I use the 2010 PVI for their current zip code, or for couples who met in 1999 I use the 2000 PVI for their MSA when they met, not the 1998 PVI. These scores represent the Democrat or Republican advantage in the district based on the most recent two presidential elections, in terms of vote percentage (e.g. "D+5"). I recoded these into absolute values to create a scale of

partisanship, ignoring which party had the advantage in the district, such that D+10 and R+10 both become scores of 10, with zeroes representing evenly split districts.

I measure local religious diversity at the MSA/county level using the 2010 U.S. Religion Census Religious Congregations and Membership Study (Grammich et al. 2012), a survey of the 236 major religious organizations in the U.S. as identified by the Association of Statisticians of American Religious Bodies. Note that this is information about religious groups' official membership counts in each geographic area, not a sample of people. As such, it cannot tell us about rates of self-identification or private religious identity (e.g. what proportion of the MSA identifies as Baptist, or Agnostic), only about the rates of the formal identity of congregation membership. I calculated the proportion of the MSA/county population that are the same religion as the respondent based on the estimated membership of 3 broad types of congregations (Catholic, other Christian, other religion), as well as a 4th category that is the inferred proportion of the population that are not members of any congregation.

Models

To test whether the Internet is leading people to be in more or less diverse relationships than they otherwise would have been in requires controlling for a variety of other potentially confounding factors such as education, income, local geographic density and diversity, etc. To control for these potential sources of spuriousness, I use multivariate logistic regressions predicting couple diversity, and OLS regression models to predict years of age difference between respondents and their partners.

There are a small proportion of cases with missing data, but their exclusion or inclusion in the analyses does not substantively alter the results. Over 94% of the respondents who gave any information at all about their current or most recent relationship gave full information on all of the covariates used here. Two percent of the respondents lacked geographic identifiers. The remaining cases with missing data did not answer one or more questions in the survey, most often information about their partner, such as partner's education, partner's mother's level of education, partner's politics, and partner's race. I replicated the models below using multiple imputation of the missing independent variable data, finding very similar results. I present here the models using listwise deletion of missing data.

Results

The Continued Expansion of Online Couple Formation

Figure 1 illustrates local-regression-smoothed survey-weighted rates of three mutually-exclusive types of online-formed couples: those that met through dating websites, those that met through other Internet venues, and those that met by a hybrid of offline and online venues/networks. While all have risen in prevalence since the 1990's, online dating websites and apps have risen more steadily and strongly. Other Internet venues were once more common sources of couples than dating websites, but their rise has tapered off since the mid-2000's. This may reflect the fading stigma of online dating and its growth in popularity around this time, largely replacing chat rooms and other online

romantic options. Hybrid online/offline first meetings have grown at a steady but much slower rate, and may track the rise in social networking websites/apps that make reconnections and introductions to mutual friends easier. Of the three online categories, only online dating sites and apps has a clearly upward trajectory that is suggestive of continued rapid growth. While only 66 couples in this sample identified as having met through a smartphone dating app, I estimate that such apps account for a little over 18% of the couples who met through either dating websites or apps from 2010 to 2016, or about 4% of all couples who met during that period.

Respondents who found their partners online exhibit a variety of differences from those who found a partner purely offline (Table 2), which reinforces the need for multivariate controls in estimating the Internet's effects on exogamy. U.S. residents who met their partner online were more often previously married ($p<.001$), more often had home Internet access prior to joining the survey panel ($p<.001$), were over four years older on average when they met their partner ($p<.001$), and those relationships were on average almost three years newer at the time of the survey ($p<.001$). Those who found their partner online also tend to live in higher income zip codes ($p<.01$), and in metropolitan areas or counties with more people educationally different from themselves ($p<.05$). Yet on many social dimensions, there are far fewer differences between those who met their partners online versus offline than popular imagination may have it.

Meeting Online and Exogamy

Couples who met online since 1996 are 7 percent more often interracial than couples who met purely offline (Table 3), but this ignores potential confounding factors. From the multivariate model in Table 4, I estimate that couples who met online have over one and a half times greater odds of crossing the major racial/ethnic boundaries of the U.S., or an average 6% greater probability across the observed values of the covariates ($p<.01$), similar to the observed bivariate difference. While there's not a difference between online and offline-formed couples in their closeness on the educational scale (not shown), couples who met online are more likely to include both a college graduate and a non-graduate, both bivariately (Table 3) and with controls (Table 4). Those who met purely online have over 1.5 times greater odds of this kind of educational exogamy, or a 7.5% increased probability on average ($p<.01$). This is also similar to the observed bivariate difference of 7.5% in couples formed since 1996. As reported in previous studies (Potarca 2017; Rosenfeld and Thomas 2012), couples who met online are more likely to be interreligious, 13% more often in simple bivariate terms (Table 3). Controlling for other factors, I estimate online-formed couples to have over 1.8 greater odds of being of different religions (Table 4), or a 12.5% increased probability across observed values of the covariates ($p<.01$).

Couples who met through the Internet are more endogamous in one regard: they are more similar in age than those who met offline. While the bivariate difference is small and not statistically significant (Table 3), once other factors are controlled for I estimate that those who met online are more than six tenths of a year closer in age than those who met purely offline (Table 4). Couple who met online are not more nor less likely to identify

with a different political party, however, nor are they more or less likely to have educationally dissimilar mothers.

Why Haven't We Seen This Before? Changes between the 2009 and 2017 Samples

While previous research found limited evidence of the Internet's effect on exogamy when controlling for other factors (Potarca 2017; Rosenfeld and Thomas 2012), I find robust effects of meeting online on exogamy by multiple social dimensions. What changed? The most important factor is that there are now more couples who met online, as well as more couples in general who met during the era of online dating, increasing the statistical power to detect differences between the offline and online couples in that time window. Table 5 compares results from the 2009 HCMST sample used by previous studies to results that only use the new 2017 HCMST sample. Even though the total sample size was smaller in 2017, the subsample of couples who met in the Internet era is a few hundred cases greater, allowing for larger N models here. There are likewise many more couples who met online in the newer sample: 431 compared to 257 in the 2009 sample. As a results, the standard errors for the 2017 met-online coefficients are substantially smaller. This isn't the only factor at play in producing these results: the effect sizes predicting racial and age assortativity are also larger in the 2017 data's results. This could be due to more accurate estimation of effects that have been constant, or it could be due to social change during this period. However, interaction effects between when the

couple met and meeting online were not significant for any of the exogamies examined here, so there isn't evidence of a change over time in the Internet's effects on exogamy.

Local Diversity's Impact on Exogamy: When Met versus When Surveyed

I argued above that one could use the diversity of respondents' local areas when interviewed as a good proxy for the diversity they were embedded in when they met their partners, and I do so in most of the models I present here. As I also know the MSA or county that the 2017 respondents lived in when they met their partner, I can test here whether this assumption holds for these analyses, and it does. The diversity measures of where the respondents currently live bivariately account for over 85% of the variance in the racial diversity of where they lived when they met their partner ($r=0.93$, $p<.001$), and over 90% of the variance in college degree diversity ($r=0.95$, $p<.001$), but only 12% of the political partisan voting index ($r=0.34$, $p<.001$). Table 6 compares models predicting interracial, inter-educational, and age diversity in couples, with some using information about the respondents' current metropolitan area, and others using information about the metro area they lived in when they met their partner. As the later data is only available in the 2017 sample, this reduces the N and statistical power of the models, so I compare these "MSA When Met" results (models 3) to the both full sample models that use current MSA (models 1) and the same current-MSA models with the smaller 2017-only sample (models 2). I exclude the zip code level data used in the models in Table 4, as zip

code level information was not deducible from respondents' answers about where they used to live.

The findings are consistent regardless of which geographic diversity measures are used. The differences between models 2 and models 3, which only differ in whether the current or former MSA information is being used, are minimal. The fit statistics are nearly the same, as is the strong effect of MSA level racial diversity on racial exogamy, and the other MSA diversity measures have mostly similar effects across models. The coefficient for meeting online becomes a little stronger in predicting racial exogamy in models 3, crossing the boundary between marginal and statistical significance, while changing little in predicting educational and age exogamy. Information about the MSA where the couple met should generally be preferred over the MSA when the respondent was surveyed, but here that decision doesn't affect the results, and the benefits of a more accurate estimate of local geographic diversity at the time of couple formation are outweighed by the benefits of a larger sample size, as well as the benefits of the more locally-scaled zip code level diversity data.

The independent effects of zip code diversity and metropolitan area diversity are apparent in Table 4. For both the respondent's MSA and zip code, a 10% increase in the proportion of either geographic unit that is the same race as the respondent is associated with an average 2.2% decrease in the probability of a different race partner, across observed covariate values ($p<.01$). For educational exogamy, it is the zip code level of diversity that is important, predicting on average a 3% decrease in the probability of a college degree diverse couple for each 10% increase in the proportion with the same

degree status as the respondent ($p<.001$). Religious diversity is only measured here at the MSA level, and has the strongest of the local diversity effects: for every 10% increase in the proportion of a metro area that is the same religious category as the respondent, the model predicts on average a 4.4% lower probability of an interreligious couple ($p<.01$). The partisan voting index does not have a statistically significant impact on any of the types of exogamy examined here.

Breaking Down Internet Effects on Exogamy

Comparisons with Specific Offline Sources. Table 7 compares couples who met online in any way with those who met through a variety of offline sources without any detectable role of the Internet (similarly to Potarca [2017]). This division of the offline meetings are based on the data authors' coding of the respondent's stories of how they met their partner. Those codes are not mutually exclusive, so I apply the following rules to categorize cases that identify multiple of these codes: any case that identifies family brokerage are always classified as Family, and any remaining cases that identify a religious setting is classified as Religious, and then any remaining cases that identify a school setting are classified as a School meeting. Then I continue this process for Work, Voluntary Organizations, Friend Introductions, and lastly Neighbors, in that order. Remaining cases that identify none of these fall into the Other category, which includes bars and restaurants, pre-Internet singles services, vacations, and meetings in public. Thus an introduction through friends at a bar would be classified as a Friend introduction,

while introduction through friends at church would be a Religious introduction. Work meetings include business trips, customer service encounters, and military service. The Friend category includes private parties and introductions through a prior significant other.

The Internet's effects on exogamy vary somewhat by the offline source it is being compared to. Online-formed couples are more likely to be interracial than those met in educational settings, through family, or in the Other Offline settings category. Couples who met online rather than through schooling have a one and two thirds greater odds of an interracial relationship, or on average a 6.4% higher probability across the observed covariates ($p<.05$). Compared to meeting through family and the Other Offline sources, online couples have twice as high odds of cross racial\ethnic lines, or an average 8.4% higher probability ($p<.01$). Online-formed couples aren't more interracial than neighbor-brokered romances, and the differences between online and friend introductions, work or voluntary organizations are statistically insignificant. Unsurprisingly, couples who meet in educational settings have half the odds of being different in college degree status than those who meet online (or an average 12% lower probability, $p<.001$), but there are also strong educational exogamy effects from meeting online versus family and friendship brokered romances. Family introductions are the only romantic source that differs from online sources in terms of parental education exogamy: online-formed couples have one and a half times greater odds of having one mother with a college degree and one without, or on average a 7.5% higher probability ($p<.05$). Neighbors, workplaces, and settings in the Other category (largely public places) produce more age disparate couples

than meeting online, but school romances are more similar in age than Internet-formed couples. Religious settings are the only offline romantic source that predict different political exogamy than Internet sources, less than two thirds the odds of producing couples of different political affiliations than meeting online, or on average a 12.7% lower probability ($p<.05$). Couples who meet through religious settings are also far less likely to be of different religions than online couples (less than one eighth the odds, or a 31.7% average lower probability, $p<.001$), as are, to a lesser extent, those who meet through schooling, family, and voluntary organizations.

Specific Online Sources and Exogamy. In Table 8, the models from Table 4 are replicated with a more detailed categorization of online sources of romance, with the comparison group couples who met offline without any hint of Internet involvement. Also included is a hybrid category of those who met through both online and offline introductions, so that the other two online categories are meant to include only those who met as otherwise strangers online. The effect of meeting online on racial exogamy is strongest when comparing non-dating online sources of romance to strictly offline couples, and only marginally significant when comparing online dating to offline couples. Online sources other than dating websites/apps (including chat rooms, games, online organizations and unspecified online meetings) predict over 1.7 times greater odds of an interracial union than do offline romantic sources, or on average a 8.4% higher probability across observed covariate values ($p<.05$). There is not a statistically significant difference in racial exogamy between meeting through online dating versus

meeting in other ways online, nor is there for any of the other exogamies examined here. Internet effects on educational exogamy, on the other hand, are only clearly detectable between the couples that meet through dating websites compared to offline couples. Couples who meet through online dating have one and a half times greater odds of including one college graduate and one non-graduate, compared to those meeting purely offline, or on average a 7.4% higher probability ($p<.05$). Both online dating and other online spaces creates couples who are more likely to be of different religions than those who meet offline, both to similar extents: over double the odds, and on average a 14% higher probability.

Dating websites and apps produce more age-similar couples than those who meet offline, by almost 1 year less age difference. This is the only characteristic (studied here) for which meeting online creates more similar couples, and it seems to be confined to the romance-focused venues of the Internet. As in Table 4, there are not statistically significant effects of meeting online on political or mother's education exogamy. Across all of these types of exogamy, there aren't detectable differences between couples who meet through a combination of offline and online sources versus those who meet purely offline. The hybrid off/online category includes people who knew each other offline and later reconnected online, as well as those who were introduced through offline friends and settings, but initiated their communication in an online venue. Unsurprisingly, these semi-online meetings are the least different from offline sources of romance.

Estimating the Internet's Effects on Population-Level Changes in Exogamy

Is finding romantic partners online directly causing population level changes in rates of exogamy? This is a question about a counterfactual, comparing the observed rates to a hypothetical similar population that didn't develop and widely adopt online dating. A simple and straightforward way to estimate this is to ask: how different would the population look if we replaced the partners of those who met their mates online with the kinds of partners we would predict them to have met offline? I estimate this by comparing the predicted values from the models with significant Internet effects in Table 4 to the predicted values with the respondents who met their partner online switched to offline-met. This is equivalent to calculating average marginal effects, but I graph the predictions by the year couples met to show how the rates over time would be different in the counterfactual. Figure 2 displays these predicted rates of interracial couples, interreligious couples, cross-BA couples (where only one has a college degree), and predicted absolute age difference, averaged with survey weights by the year the couples met. Note that the interreligious predictions are limited to 2009 and earlier by the available data. I exclude the 2017 data points from these graphs, which were couples who had met no more than several months before the survey.

I also include a second set of counterfactual predictions to Figure 2: a hypothetical U.S. in which online dating has increased at a faster rate, closer to how it has increased in the same-sex couple population. Instead of a U.S. that saw online sources increase from less than 1% of new couples in 1992 to nearly a third by 2016, this counterfactual U.S. supposes that online-formed couples rose twice as high, accounting for two thirds of new

couples by the end of that time period. I simulate this by first calculating the predicted probability of having met one's partner online for all respondents, using the same covariates from the models in Table 4. I then double these estimated probabilities for each respondent, and use those in place of the met-online binary in the models from Table 4 to calculate their predicted exogamies. As year-met is a strong predictor of meeting online, this produces a steeper but otherwise similar increase in the online coupling rate compared to the observed increase.

I include an additional line in the graphs for interracial, interreligious, and cross-BA couple rates, that is meant to illustrate the hypothetical upper limit of intergroup mixing without any within-MSA assortativity, labeled "Random Mixing." This line represents the predicted population cross-group coupling rates if every respondent chose a partner purely at random from their current metro\micropolitan area or county, which I operationalize simply as the respondent's MSA's proportion not in the same group as the respondent. By accounting for between-MSA segregation, this baseline random mixing estimate is lower than a similar measure would be at the national level. I don't include a random mixing prediction line for age, as it would be so far removed from the other lines as to be unhelpful as a baseline comparison.

As Figure 2 illustrates, this evidence suggests that the Internet's impact on exogamy by these four dimensions is not large, but not unimportant. The rise in interracial and interreligious couples are predicted to still have occurred even if the online couples had met offline instead, but with a somewhat less steep increase, amounting to on average 1.8% fewer couples interracial each year in the 2010s, and 2.2% fewer couples of

different religions each year in the 2000s. On the other hand, the hypothetical U.S. with a majority of the couples meeting online would see somewhat steeper increases in these kinds of couple diversity, roughly 1.7% more couples crossing racial boundaries each year in the 2010's, and 2.0% more couples interreligious each year in the 2000s. College-education heterogeneity in couples has been roughly flat, but these models predict a modest increase in this kind of educational exogamy in a U.S. with more online dating, 2.3% more couples crossing that educational boundary each year in the 2010s, or a decrease in a U.S. without online dating of about 2.5% per year. Age assortativity appears to have decreased slightly in the 1990s and then experienced a recent uptick. This model estimates that couples would be a little less age similar in a world without Internet romances, by about one sixth of a year in the 2010s, or a sixth of a year more similar on average in a world in which more couples met online.

Why do some of the substantial and significant logistic regression coefficients translate into such small population effects? Effects can be both strong multiplicatively and small in impact when only a minority of the population is affected, and the outcome is relatively unlikely. In the case of interracial couples, the first model in Table 4 predicts that couples who meet online have over 1.5 greater odds of being interracial ($p<.01$), which translate on average to a 6% greater probability across the observed covariates. Limiting the temporal window to couples who met since 2009, the model predicts that if the 28% who met online had instead met offline, they would have had (on average) a 6% lower probability of being interracial. So the interracial 32% of that 28% of couples would have been reduced to 25% of 28%, resulting in (.28*.06) about 1.7 percent fewer

couples in the overall population who were interracial. This simple illustrative calculation makes some assumptions that the full predictions in Figure 2 do not make, but the results are roughly the same regardless.

These estimates come with some caveats, as they rest on a number of assumptions, including that there are not substantial confounding factors causing both interracial dating and online dating that have been omitted from the models. They also assume zero-to-minimal reverse causation in the relationship between online dating and exogamy. For instance, a cultural shift towards preferring interracial relationships might also cause people to increasingly use online dating, because of the difficulty of finding different-race partners offline. If that has happened, then the above calculations would be overestimating the role of online dating in creating interracial couples.

Note that these estimates also do not account for potential indirect effects of the Internet on couple diversity. For instance, interracial friendships and relationships begun online could in turn introduce new interracial couples offline who wouldn't otherwise meet (Ortega and Hergovich 2017). Such introductions are acts of transitive closure, which typically compounds homophily in social networks (Goodreau et al. 2009), but can also magnify the bridging of group boundaries (Mark and Harris 2012). Second-order and nth-order network effects can't be estimated with this data, and cannot be ruled out.

Discussion and Conclusion

Online sources of romance are related to greater couple diversity than offline-formed romances, but not in all social characteristics. Couples who meet online are more likely to

be different in race/ethnicity, religion and college degree status than are couples who find each other offline, but more similar in age. Despite concerns that online interactions increase sorting by politics and social class, couples who met online are not more nor less likely to identify with different political parties than those who met offline, nor are they more similar in their mothers' education levels. The specific online venues through which couples meet also seems to matter for many of these types of exogamy, with online dating most clearly related to age similarity and educational diversity in couples compared to offline sources, while other online sources are most clearly related to more interracial couples. Couples who met through a hybrid of offline and online sources are not significantly different in any of these dimensions from purely offline-formed couples, which suggests that the connection of socially-distant strangers may lie at the heart of the Internet's effect on exogamy. The predicted rates of population level exogamy without Internet-formed couples illustrate that while meeting online quite significantly increases the odds of couple heterogeneity for any given respondent, the Internet has had a more limited (but still meaningful) impact on exogamy in the population as a whole. On the other hand, the predicted rates for a hypothetical U.S. with more online-formed couples illustrate that the Internet's potential to impact exogamy can be more consequential, though perhaps not the sea change that some have envisioned.

These findings serve as a reminder of the importance of the structure of opportunities for partners as a determinant of endogamy, as well as a reminder to question explanations that rely too heavily on personal preferences. Faced with larger and more diverse pools of potential partners online, it may very well be that users act more on choice homophily

biases than they do offline, but the results are still less segregated outcomes. This may not be true within every online dating market, however: the findings of this study are about differences averaged across the U.S. population, and the effects of meeting online may vary by local geographic market as well as by particular websites and online spaces. In between the national level scope of the analysis here and the single-website-specific scope of many studies of online dating, there is room and a need for more research that examines the factors influencing variance across online dating markets in assortativity.

The rising importance of online social foci in creating new relationships has created a new structural source of homophily that deserves more of our attention: the user interface. The early insight from a famous New Yorker cartoon that "On the Internet, nobody knows you're a dog," (Steiner 1993) is truer for some interfaces than for others. Some highlight demographic categories, while others obscure them. The closer age similarity of couples who meet through online dating websites and apps, and the lack of an age difference between couples who meet elsewhere online vs offline, show that the Internet can create more homogenous relationships when interface and intentionality interact to heighten sorting on a social dimension. Some interfaces also encourage cultural homophily more than others; the prompting to list favored cultural items and activities that has been typical of online dating websites is an extreme example, but this can occur more subtly as well. The presentation of self, and the construction of online versions of oneself, are also influenced by the design of the interface, as well as by the perceived cultural standards of that space (Hobbs et al. 2017). By shaping how users

perceive not just each other but also themselves online, interfaces can heighten some homophilies while dampening others.

The rise of smartphone dating apps, potentially replacing online dating websites as the primary source of finding mates online, may represent a significant change in interface-induced endogamy. Unlike dating websites, apps typically steer users to make quick initial decisions based primarily on photos and taglines, rather than more in depth perusal of personal essays and lists of tastes and personal details (Ansari and Klinenberg 2015). This may reduce the cultural homophily of online dating, and the endogamy of social characteristics that are correlated with culture. On the other hand, dating apps often sort users based upon their phones' moment-by-moment geographic proximity. This may have the effect of segregating users by geographies at a smaller scale than dating websites typically do, though not simply by where they live, but also by workplace and entertainment locations. With too few app-created couples detectable in the data used here to generalize from, we may have to wait for data that can measure the effects of this change.

The sizeable minority of couples who meet through online communities and groups highlight the need for a better understanding of the structure and dynamics of voluntary groups online, as these may differ in important ways from offline organizational dynamics that affect the homogeneity within them. For instance, the adaptive mechanisms described by population ecology approaches to voluntary groups (McPherson and Ranger-Moore 1991) may operate with less friction online, as organizations' members can appear and disappear with fewer ramifications to the rest of

their social networks. Differences in how new members are recruited into online organizations, as well as the ability to selectively reveal information about oneself to an online group, may also lead to differences in how the homophily principle confines online organizations to specific locations in sociodemographic space (i.e. Blau space). The homogeneity or diversity of online communities and games not only directly impacts the composition of the couples who meet within them, but also the friendships that they create, and the ripple effects those have on social networks online and offline.

Segregation is almost always present online, on all of the dimensions discussed here, but if the Internet is simply less highly-segregated than the offline world it can act as an integrating force in society. Social activity and communication in general have shifted from more traditional venues and media to the Internet, and that may continue to increase across a wide range of activities. To understand how this alters the segregation of social life in the U.S. and around the world, we need to more often find ways to compare online assortativity to what people experience offline. For instance, while it may be that interaction on social media is quite segregated by a variety of social characteristics, it is not entirely clear whether online "echo chambers" or "bubbles" are exposing people to more or less homogeneous viewpoints than what they get from their daily offline social lives.

The popularity of online dating can be seen as a remarkable breech of social closure. Unlike other non-exclusive and public settings for finding new partners, those higher in the economic, educational and racial hierarchies of the U.S. aren't less likely to meet a new partner online (Thomas 2018). As the role of the Internet expands in couple

formation, romantic opportunities for high status partners aren't being hoarded online, at least not in the sense that such opportunities are sequestered within status-segregated settings and networks (Tilly 1998). While other assortative mechanisms may be at work online to bias those in higher status group positions to partner more often with each other, the evidence here shows that this is less effective that offline romantic social closure, as racial, religious and educational boundaries are more often crossed online. Increasingly routine transgression of these boundaries threatens their salience, as well as the "groupness" of the corresponding social class, ethnic and racial groups (Wimmer 2008). Many of these boundary-crossing couples will form families and raise children, potentially creating a new generation of Americans for whom these boundaries seem less consequential than they did for previous generations. This may still turn out to be a brief and unusual period of unsequestered romantic opportunities, to be followed by a reinvention of romantic social closure online. Or this may very well be the beginning of a new openness in the market for mates.

Online interaction in general can be characterized by contradictory tendencies towards barrier-less communication and self-selection into culturally narrow venues. How people find romantic partners online is a reflection of this tension, encountering both vaster arrays of potential partners as well as conscious and meticulous sorting on a variety of characteristics. The net result for couple characteristics is generally more diversity than found in offline-formed couples, but far less than the potential of a boundary-less mating market would suggest.

References

Adamic, Lada A. and Natalie Glance. 2005. “The Political Blogosphere and the 2004 U.S. Election: Divided They Blog.” *Proceedings of the Third International Workshop on Link Discovery* pp. 36-43.

Ansari, Aziz and Eric Klinenberg. 2015. *Modern Romance.* New York: Penguin Press.

The American National Election Studies (www.electionstudies.org). 2017. *The ANES Guide to Public Opinion and Electoral Behavior.* Ann Arbor, MI: University of Michigan, Center for Political Studies.

Baker, Reg, Stephen J. Blumberg, J. Michael Brick, Mick P. Couper, Melanie Courtright, J. Michael Dennis, Don Dillman, Martin R. Frankel, Philip Garland, Robert M. Groves, Courtney Kennedy, Jon Krosnick, Paul J. Lavrakas, Sunghee Lee, Michael Link, Linda Piekarski, Kumar Rao, Randall K. Thomas, and Dan Zahs. 2010. “Research Synthesis: AAPOR Report on Online Panels.” *Public Opinion Quarterly* 74: 711-781.

Blau, Peter M. 1977. *Inequality and Heterogeneity*. New York: The Free Press.

Blau, Peter M., Terry Blum, and Joseph E. Schwartz. 1982. "Heterogeneity and Intermarriage." *American Sociological Review* 47: 45-62.

Bossard, James H. S. 1932. "Residential Propinquity as a Factor in Marriage Selection." *American Journal of Sociology* 38,2: 219-24.

Bruch, Elizabeth, Fred Feinberg, and Kee Yeun Lee. 2016. “Extracting Multistage Screening Rules from Online Dating Activity Data.“ *PNAS* 113,38: 10530-10535.

Carley, Katherine M. 1991. "A Theory of Group Stability." *American Sociological Review* 56: 331-354.

Chang, Linchiat and Jon A. Krosnick. 2009. “National Surveys via RDD Telephone Interviewing versus the Internet: Comparing Sample Representativeness and Response Quality.” *Public Opinion Quarterly* 73: 661-674.

Couper, Mick P. 2000. “Web Surveys: A Review of Issues and Approaches.” *Public Opinion Quarterly* 64: 464-494.

Dutton, William H., Ellen J. Helsper, Monica T. Whitty, J. Galen Buckwalter, and Erina Lee. 2009. “The Role of the Internet in Reconfiguring Marriages: A Cross-National Study.” *Interpersona* 3, suppl. 2: 3-18.

Feld, Scott L. 1982. “Social Structural Determinants of Similarity among Associates.” *American Sociological Review* 47,6: 797-801.

Fricker, Scott, Mirta Galesic, Roger Tourangeau and Ting Yan. 2005. “An Experimental Comparison of Web and Telephone Surveys.” *Public Opinion Quarterly* 69: 370-92.

Goodreau, Steven M., James A. Kitts and Martina Morris. 2009. “Birds of a Feather, or Friend of a Friend? Using Exponential Random Graph Models to Investigate Adolescent Social Networks.” *Demography* 46,1: 103-25.

Grammich, Clifford, Kirk Hadaway, Richard Houseal, Dale E. Jones, Alexei Krindatch, Richie Stanley, and Richard H. Taylor. 2012. *2010 U.S. Religion Census: Religious Congregations & Membership Study.* Lenexa, KS: Association of Statisticians of American Religious Bodies.

Hitsch, Günter J., Ali Hortaçsu, and Dan Ariely. 2010. “Matching and Sorting in Online Dating.” *American Economic Review* 100: 130-163.

Heino, Rebecca D., Nicole B. Ellison, and Jennifer L. Gibbs. 2010. “Relationshopping: Investigating the Market Metaphor in Online Dating.” *Journal of Social and Personal Relationships* 27,4: 427-447.

Hobbs, Mitchell, Stephen Owen, and Livia Gerber. 2017. “Liquid Love? Dating Apps, Sex, Relationships and the Digital Transformation of Intimacy.” *Journal of Sociology* 53,2: 271-284.

Huber, Gregory A. and Neil Malhotra. 2017. “Political Homophily in Social Relationships: Evidence from Online Dating Behavior.” *The Journal of Politics* 79,1: 269-283.

Kalmijn, Matthijs. 1998. "Intermarriage and Homogamy: Causes, Patterns, Trends." *Annual Review of Sociology* 24: 395-421.

Kalmijn, Matthijs and Henk Flap. 2001. “Assortative Meeting and Mating: Unintended Consequences of Organized Settings for Partner Choices.” *Social Forces* 79,4: 1289-1312.

Lee, Soohyung. 2015. “Effect of Online Dating on Assortative Mating: Evidence from South Korea.” *Journal of Applied Econometrics* 31: 1120-1139.

Lewis, Kevin, Jason Kaufman, Marco Gonzalez, Andreas Wimmer, and Nicholas Christakis. 2008. “Tastes, Ties, and Time: A New Social Network Dataset Using Facebook.com.” *Social Networks* 30: 330-342.

Lewis, Kevin. 2016. “Preferences in the Early Stages of Mate Choice.” *Social Forces*

95,1: 283–320.

Lin, Ken-Hou and Jennifer Lundquist. 2013. “Mate Selection in Cyberspace: The Intersection of Race, Gender, and Education.” *American Journal of Sociology* 119,1: 183-215.

Mark, Noah. 1998. “Birds of a Feather Sing Together.” *Social Forces* 77,2: 453-485.

Mark, Noah P. and Daniel R. Harris. 2012. “Roommate’s Race and the Racial Composition of White College Students’ Ego Networks.” *Social Science Research* 41: 331-42.

McPherson, J. Miller and Lynn Smith-Lovin. 1987. “Homophily in Voluntary Organizations: Status Distance and the Composition of Face-to-Face Groups.” *American Sociological Review* 52,3: 370-379.

McPherson, J. Miller and James R. Ranger-Moore. 1991. “Evolution on a Dancing Landscape: Organizations and Networks in Dynamic Blau Space.” *Social Forces* 70,1: 19-42.

Missouri Census Data Center. 2012. MABLE/Geocorr12, Version 1.2: Geographic Correspondence Engine. Web application accessed October 2017 (http://mcdc.missouri.edu/websas/geocorr12.html)

Moody, James. 2001. “Race, School Integration, and Friendship Segregation in America.” *American Journal of Sociology* 107,3: 679-716.

Ortega, Josué and Philipp Hergovich. 2017. “The Strength of Absent Ties: Social Integration via Online Dating.” arXiv:1709.10478 [physics.soc-ph]. Retrieved November 2017 (https://arxiv.org/abs/1709.10478).

Potarca, Gina. 2017. “Does the Internet Affect Assortative Mating? Evidence from the U.S. and Germany.” *Social Science Research* 61: 278-297.

Robnett, Belinda and Cynthia Feliciano. 2011. “Patterns of Racial-Ethnic Exclusion by Internet Daters.” *Social Forces* 89,3: 807-828.

Rosenfeld, Michael J. and Reuben J. Thomas. 2012. “Searching for a Mate: The Rise of the Internet as a Social Intermediary.” *American Sociological Review* 77,4: 523-547.

Rosenfeld, Michael J., Reuben J. Thomas, and Maja Falcon. 2015. *How Couples Meet and Stay Together, Waves 1, 2, and 3: Public version 3.04, plus Wave 4 Supplement Version 1.02 and Wave 5 Supplement Version 1.0* [Data file]. Stanford, CA: Stanford University Libraries. http://data.stanford.edu/hcmst

Rudder, Christian. 2014. *Dataclysm: Who We Are (When We Think No One’s Looking).* New York: Crown.

Skopek, Jan, Florian Schulz and Hans-Peter Blossfeld. 2011. “Who Contacts Whom? Educational Homophily in Online Mate Selection.” *European Sociological Review* 27,2: 180-195.

Smith, Aaron and Maeve Duggan. 2013. *Online Dating & Relationships.* Washington, D.C.: Pew Research Center. Retrieved October 21, 2013 (http://pewinternet.org/Reports/2013/Online-Dating.aspx)

Stark, Tobias H. and Andreas Flache. 2012. “The Double Edge of Common Interest: Ethnic Segregation as an Unintended Byproduct of Opinion Homophily.” *Sociology of Education* 85,2: 179-199.

Steiner, Peter. 1993. “On the Internet, Nobody Knows You’re a Dog.” *The New Yorker* 69,20: 61.

Thomas, Reuben J. 2018. “Romantic Opportunity Hoarding: Social Closure through Disproportionate Romantic Brokerage, by Group Position and Gender.” Working paper, March 4, 2018.

Tilly, Charles. 1998. *Durable Inequality.* Berkeley, CA: University of California Press.

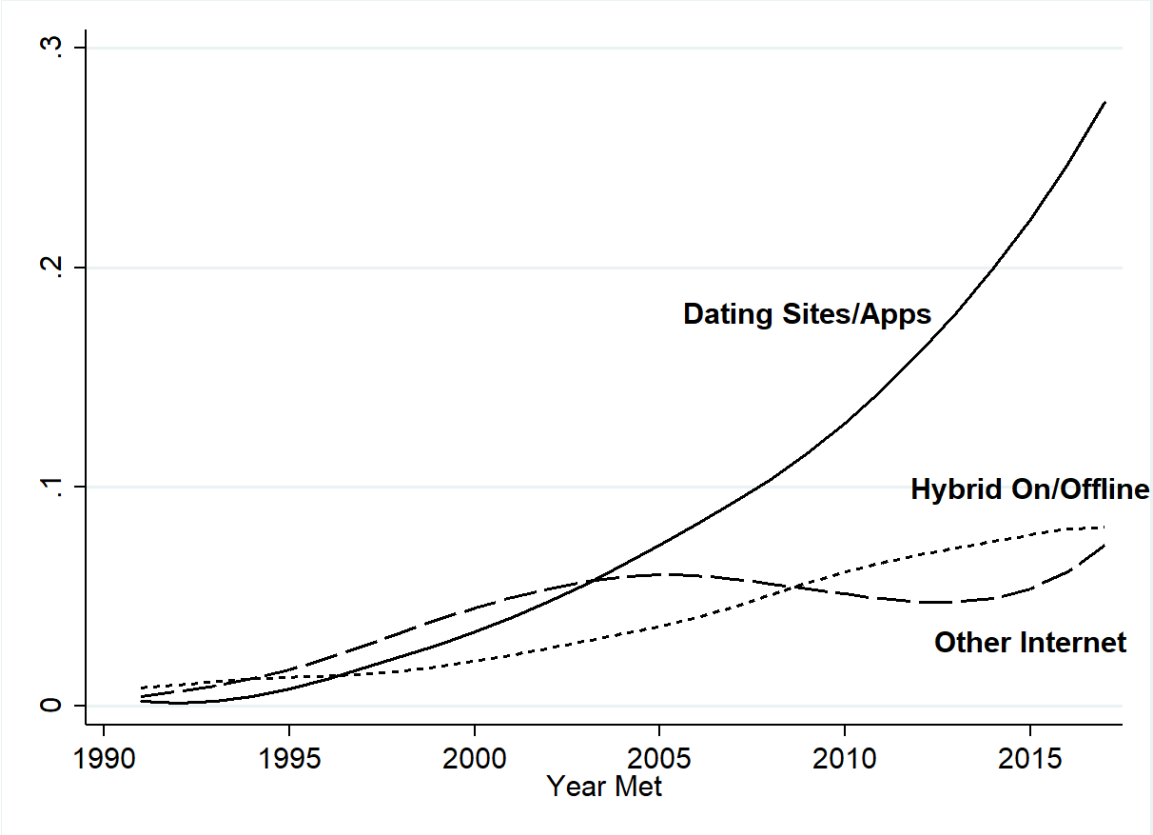
U.S. Census Bureau. 2015. American Community Survey 5-Year Estimates, Table S0601 generated using American FactFinder. Retrieved October 2017 (http://factfinder.census.gov)

Wasserman, David and Ally Flinn. 2017. “Introducing the 2017 Cook Political Report Partisan Voter Index.” *The Cook Political Report.* Retrieved April 7, 2017 (http://cookpolitical.com/introducing-2017-cook-political-report-partisan-voter-index)

Wimmer, Andreas. 2008. “The Making and Unmaking of Ethnic Boundaries: A Multilevel Process Theory.” *American Journal of Sociology* 113,4: 970-1022.

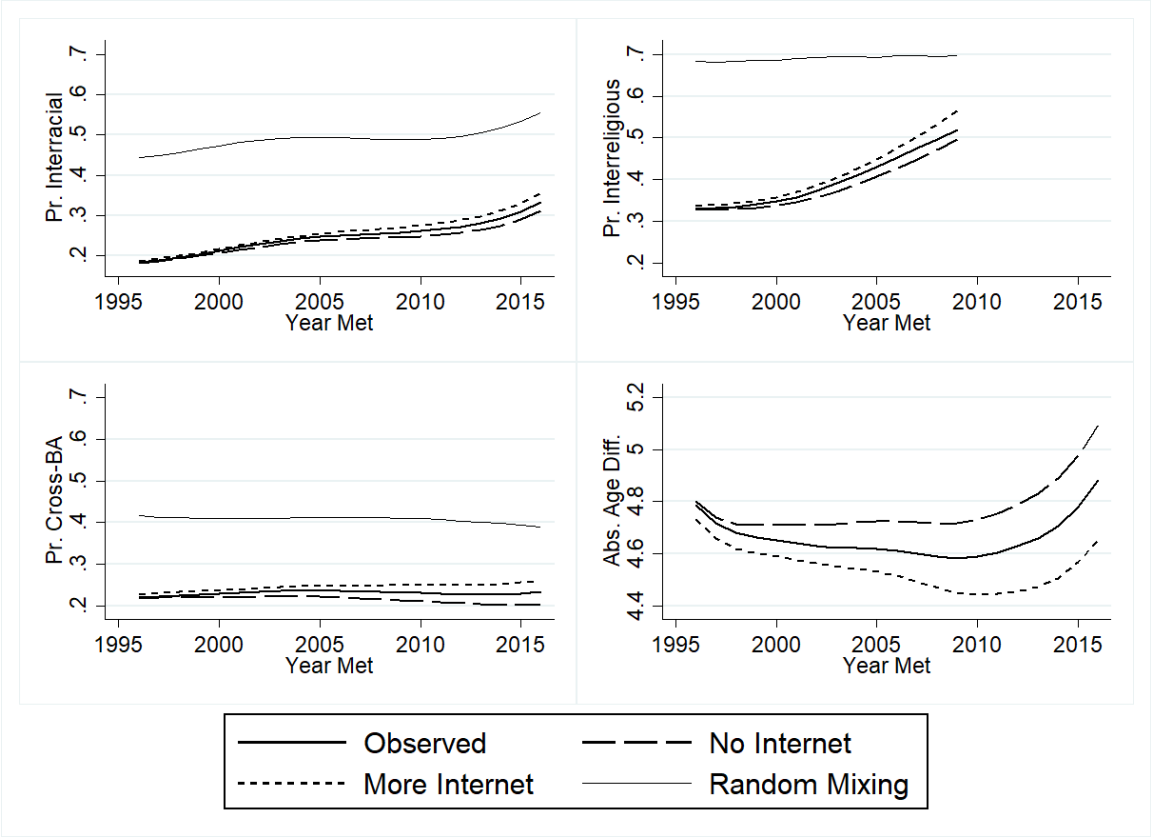
Wimmer, Andreas and Kevin Lewis. 2010. “Beyond and Below Racial Homophily: ERG Models of a Friendship Network Documented on Facebook.” *American Journal of Sociology* 116,2: 583-642.

Figure 1. Proportions of Couples who Met Online, by Year and Online Source



Survey-weighted lowess regression-smoothed lines (bandwidth=.8), 1991 to 2016

Figure 2. Estimated Population Level Exogamy Given Observed and Hypothetical Rates of Online Romance Formation, by Year Met



Predicted values from models in Table 4, survey-weighted lowess regression-smoothed lines (bandwidth=.8)

Table 1. Sample Descriptives

	N	Proportion	Mean	Std. Dev.
Couple Characteristics				
Met Online At All	688	0.23		
Met Through Online Dating Only	356	0.12		
Met Through Other Online Source Only	191	0.06		
Met Both On- and Offline	133	0.04		
Met Purely Offline	2356	0.78		
Different Race/Ethnicity	741	0.24		
Different Religion (2009 sample only)	576	0.43		
Different Political Party	1340	0.44		
Different College Degree Status	786	0.26		
Different Mother's College Degree Status	820	0.27		
Absolute Age Difference			4.98	(5.83)
Same Sex Couple	482	0.16		
Married	1353	0.45		
Coresident	2007	0.66		
Year Met			2005.58	(5.94)
Age Met			30.45	(12.95)
Relationship Length, in years			7.42	(5.60)
Retrospective Relationship Subsample	285	0.09		
Respondent Characteristics				
Age			38.33	(13.37)
College Graduate	1199	0.39		
Mother a College Graduate	744	0.25		
Previously Married	875	0.29		
Home Internet Prior to Survey Panel	2800	0.92		
Race/Ethnicity				
White Non-Hispanic	2086	0.69		
Hispanic	395	0.13		
Black Non-Hispanic	337	0.11		
Asian Non-Hispanic	96	0.03		
Other Race	122	0.04		
Political Party Identification				
Republican	1110	0.37		
Democrat	1847	0.61		
Other	79	0.03		
Religious Identification (2009 sample only)				
Catholic	293	0.22		
Protestant or Other Christian	672	0.50		
Other Religion	121	0.09		
No Religious Identification	253	0.19		

# of Children in Household			0.60	(1.02)
Household Income Scale			12.18 ($50k's)	(4.55)
Local Geography				
% of Zipcode R's Race/Ethnicity			0.60	(0.30)
% of MSA/County R's Race/Ethnicity			0.54	(0.27)
% of Zipcode R's College Degree Status			0.59	(0.24)
% of MSA/County R's College Degree Status			0.56	(0.21)
% of MSA/County R's Religion (2009 only)			0.30	(0.18)
Congressional District Partisan Voting Index			12.59	(9.20)
Zipcode Per Capita Income, in $1000's			15.60	(15.59)
MSA/County Median Income, in $1000's			27.71	(4.81)
Region				
Northeast	562	0.19		
Midwest	675	0.22		
South	1043	0.34		
West	756	0.25		
Sample				
2009	1342	0.44		
2017	1694	0.56		
Total N	3036			

Notes: This subsample only includes respondents who met their partners in 1996 or later.

Table 2. Survey-Weighted Proportions and Means of Covariates, by How Couples Met (Since 1996)

	Met Purely Offline	Met Online or Both	Total
Age Met	28.07	32.15	28.84
Years Known	8.76	5.77	8.20
Household Income Scale	12.07	11.96	12.05
College Graduate R	0.32	0.37	0.33
R's Mother a College Grad.	0.23	0.23	0.23
R's Age at Survey	36.84	37.93	37.04
R Previously Married	0.26	0.37	0.28
R Had Home Internet	0.91	0.96	0.92
R's Race			
White NH	0.61	0.64	0.61
Black	0.14	0.10	0.14
Hispanic	0.17	0.17	0.17
Asian	0.05	0.06	0.05
Other	0.03	0.03	0.03
R's Party			
Republican	0.40	0.40	0.40
Democrat	0.57	0.58	0.57
Other	0.03	0.02	0.03
R's Religion			
Catholic	0.23	0.21	0.23
Other Christian	0.53	0.52	0.53
Other Religion	0.07	0.07	0.07
Non-Religious	0.17	0.19	0.18
Region			
Northeast	0.18	0.19	0.18
Midwest	0.21	0.22	0.21
South	0.37	0.37	0.37
West	0.24	0.23	0.24
MSA Population	3,715,235	3,839,577	3,738,551
Zipcode Pr. R's Race	0.58	0.58	0.58
MSA Pr. R's Race	0.51	0.51	0.51
Zipcode Pr. R's BA	0.63	0.60	0.62
MSA Pr. R's BA	0.59	0.57	0.59
MSA Pr. R's Religion	0.31	0.33	0.31
District Republicanness	-0.74	-1.08	-0.81
District Partisan Index	12.78	12.97	12.81
Zipcode Income Per Capita	16,607.30	19,096.86	17,074.13
MSA Median Income	27,443.84	27,717.78	27,495.21
N	2348	688	3036

Survey-weighted estimates from a subsample of couples who met after 1995.

Table 3. Survey-Weighted Proportions and Means of Couple Differentiation, by How Couples Met (Since 1996)

	Different Race/ Ethnicity	Different Religion	Different College Degree	Different Mother's College	Different Party	Age Difference
Met Online	0.30	0.51	0.30	0.27	0.49	4.46
Met Purely Offline	0.23 **	0.38 *	0.22 ***	0.25	0.45	4.63
Online Sub-Categories						
Dating Site	0.27	0.51	0.34	0.33	0.45	4.50
Other Online	0.32	0.57	0.25	0.17	0.55	5.31
On/Offline	0.34	0.29	0.26	0.26	0.50	3.50
Purely Offline	0.23 *	0.38 *	0.22 **	0.25 *	0.45	4.63
Total	0.25	0.40	0.23	0.25	0.46	4.60
Sample Years	Both	2009	Both	Both	Both	Both
N	3030	1335	3032	2989	3015	3017

Survey-weighted estimates from a subsample of couples who met after 1995.
Chi-square tests within columns: * p<.05, ** p<.01, *** p<.001

Table 4. Logistic and OLS Regression Coefficients Predicting Exogamy by Meeting Online (Since 1996)

	Different Race/ Ethnicity	Different Religion	Different College Degree Status	Different Mother's College Graduate Status	Different Political Party	Absolute Age Difference
Model	Logit	Logit	Logit	Logit	Logit	OLS
Met Online At All	0.42**	0.61**	0.44**	0.02	0.11	-0.62*
Local Proportion Same as R:						
Zipcode – Race	-1.70***	-0.00	0.05	0.05	0.01	-0.87
MSA – Race	-1.67**	0.14	-0.37	-0.77+	0.27	-0.56
Zip – BA Status	0.12	-0.92	-1.91***	-0.36	0.28	0.02
MSA – BA Status	-0.55	0.39	0.59	0.06	-0.24	1.52
MSA – Religion		-2.23**				
District Partisan Index	0.01	0.01	-0.00	-0.01	-0.01	0.01
R^2						0.12
McFarland's Psuedo-R^2	0.23	0.13	0.08	0.13	0.05	
Sample Years	Both	2009	Both	Both	Both	Both
N	3030	1335	3032	2989	3015	3017

+ p<.1, * p<.05, ** p<.01, *** p<.001

Survey-weighted estimates from a subsample of couples who met after 1995. Covariates not shown: Race, Age, Education Scale, Income, Married, Coresident, Years Known, Number of Children in Household, Same Sex, Year Sampled, Relationship Duration, Still Together, Previously Married, Home Internet Access, Region, MSA/County Population and Median Income, and Zipcode Per Capita Income. Religion models include R's religion and political models include R's political party. For full model coefficients, see Appendix Table A1, available at: http://www.unm.edu/~reubenjthomas/OnlineExogamyAppendix.pdf

Table 5: Effects of Meeting Online on Couple Exogamy, by Sample and Controls

	2009 Sample			2017 Sample		
	1	2	3	1	2	3
	Minimal Controls	Full Respondent Controls	Full Respondent Controls + Geo Controls	Minimal Controls	Full Respondent Controls	Full Respondent Controls + Geo Controls
Effect of Meeting Online on:						
Interracial Log Odds	0.12	0.26	0.37	0.34*	0.39*	0.42*
	(0.27)	(0.28)	(0.29)	(0.16)	(0.17)	(0.18)
N	1404	1400	1340	1748	1739	1693
Pseudo R^2	0.32	0.33	0.37	0.11	0.12	0.17
Different College Dgr. Log Odds	0.29	0.38+	0.45+	0.37*	0.38*	0.42*
	(0.23)	(0.23)	(0.24)	(0.16)	(0.16)	(0.17)
N	1405	1402	1342	1749	1739	1693
Pseudo R^2	0.05	0.07	0.10	0.05	0.06	0.07
Age Difference	-0.32	-0.38	-0.48	-0.41	-0.62+	-0.74*
	(0.50)	(0.48)	(0.48)	(0.35)	(0.35)	(0.35)
N	1402	1398	1338	1737	1728	1682
Adjusted R^2	0.09	0.11	0.13	0.12	0.13	0.13

+ p<.1, * p<.05, ** p<.01, *** p<.001

Survey-weighted estimates from a subsample of couples who met after 1995. Standard errors are in parentheses. Minimal controls include the respondent's characteristic in question, respondent age, years since the couple met, and home internet access prior to joining the survey panel. Full respondent controls additionally include race, education scale, income, political party, married, coresident, years known, number of children in household, same sex, year sampled, relationship duration, still together, previously married, home internet access and region. Geo controls include MSA/county population and median income, zip code per capita income, racial/ethnic and college degree diversity for both zip code and MSA, and political partisanness for the respondent's congressional district. For full model coefficients, see Appendix Tables A4a-c, available at: http://www.unm.edu/~reubenjthomas/OnlineExogamyAppendix.pdf

Table 6: Exogamy by Online-vs-Offline: Current MSA vs. MSA When Met

	Different Race/Ethnicity (Logit Coefficients)			Different College Degree (Logit Coefficients)			Absolute Age Difference (OLS Coefficients)		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Sample Years	Both	2017	2017	Both	2017	2017	Both	2017	2017
Met Online At All	0.41**	0.35+	0.40*	0.39**	0.42*	0.44*	-0.63*	-0.85*	-0.85*
	(0.15)	(0.19)	(0.17)	(0.14)	(0.17)	(0.17)	(0.28)	(0.35)	(0.34)
Local Proportion Same as R:									
Current MSA – Race	-3.27***	-3.54***		-0.36	0.16		-1.35	-0.19	
MSA When Met – Race			-3.57***			0.15			-0.66
Current MSA – BA Status	-0.38	-0.29		-1.19**	-0.65		1.56+	1.06	
MSA When Met – BA Status			0.08			0.07			1.77+
Current District Partisan Index	0.00	0.00		-0.01	-0.00		0.01	0.02	
District When Met Partisan Index			0.01			-0.01			0.03
R^2							0.12	0.15	0.15
McFarland's Psuedo-R^2	0.22	0.18	0.18	0.07	0.07	0.07			
N	3030	1579	1579	3032	1579	1579	3017	1571	1571

+ p<.1, * p<.05, ** p<.01, *** p<.001

Survey-weighted estimates from a subsample of couples who met after 1995. Standard errors for Met Online are in parentheses. Covariates not shown: Race, Age, Education Scale, Income, Political Party, Married, Coresident, Years Known, Number of Children in Household, Same Sex, Year Sampled, Relationship Duration, Still Together, Previously Married, Home Internet Access, Region, and MSA/County Population and Median Income. For full model coefficients, see Appendix Tables A5a-c, available at: http://www.unm.edu/~reubenjthomas/OnlineExogamyAppendix.pdf

Table 7. Odds Ratios and OLS Regression Coefficients Predicting Exogamy by Romantic Source (Since 1996)

Coefficient Type	Different Race/ Ethnicity Odds Ratios	Different Religion Odds Ratios	Different College Degree Status Odds Ratios	Different Mother's College Graduate Status Odds Ratios	Different Political Party Odds Ratios	Absolute Age Difference OLS Coefficients
Source of Introduction (vs Online)						
Friends	0.68^{+}	0.69	0.65*	1.00	1.13	0.31
Family	0.50**	0.48*	0.58*	0.60*	0.83	0.56
Neighbors	1.81	1.73	0.58	0.73	0.88	5.12***
Work	0.79	0.65	0.74^{+}	1.18	0.92	1.35***
School/College	0.60*	0.52*	0.48***	1.03	0.87	-0.70*
Religious Org.	0.65	0.12***	0.61^{+}	1.03	0.56*	-0.42
Voluntary Org.	0.96	0.37*	1.67	1.65	0.52^{+}	1.82
Other Source	0.49**	0.67	0.76	0.84	0.72	1.61**
R^2						0.15
McFarland's Psuedo-R^2	0.23	0.15	0.08	0.13	0.06	
Sample Years	Both	2009	Both	Both	Both	Both
N	2896	1309	2898	2860	2884	2885

+ p<.1, * p<.05, ** p<.01, *** p<.001

Survey-weighted estimates from a subsample of couples who met after 1995. Covariates not shown: Race, Age, Education Scale, Income, Political Party, Married, Coresident, Years Known, Number of Children in Household, Same Sex, Year Sampled, Relationship Duration, Still Together, Previously Married, Home Internet Access, Region, MSA/County Population and Median Income, and Zipcode Per Capita Income. Religion models include R's religion. For full model coefficients, see Appendix Table A3, available at: http://www.unm.edu/~reubenjthomas/OnlineExogamyAppendix.pdf

Table 8. Logistic and OLS Regression Coefficients Predicting Exogamy by Online Source (Since 1996)

	Different Race/ Ethnicity	Different Religion	Different College Degree Status	Different Mother's College Graduate Status	Different Political Party	Absolute Age Difference
Model	Logit	Logit	Logit	Logit	Logit	OLS
Source of Introduction (vs Purely Offline)						
Dating Site/App	0.36+	0.71*	0.43*	0.17	-0.02	-0.93*
Other Online	0.58*	0.71*	0.30	-0.19	0.37+	-0.05
Both Off- & Online	0.27	-0.46	0.47+	-0.20	0.06	-0.61
R^2						0.12
McFarland's Psuedo-R^2	0.23	0.14	0.08	0.13	0.05	
Sample Years	Both	2009	Both	Both	Both	Both
N	3030	1335	3032	2989	3015	3017

+ p<.1, * p<.05, ** p<.01, *** p<.001

Survey-weighted estimates from a subsample of couples who met after 1995. Covariates not shown: Race, Age, Education Scale, Income, Political Party, Married, Coresident, Years Known, Number of Children in Household, Same Sex, Year Sampled, Relationship Duration, Still Together, Previously Married, Home Internet Access, Region, MSA/County Population and Median Income, and Zipcode Per Capita Income, Racial/Ethnic and College Degree Diversity for both zip code and MSA, and Political Partisanness for the respondent's congressional district. Religion models include R's religion. For full model coefficients, see Appendix Table A2, available at: http://www.unm.edu/~reubenjthomas/OnlineExogamyAppendix.pdf