"I'm Feeling Lucky":

Identifying Novel Correlates of Sexual Infidelity via Google Search Databases

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Abstract

Today, survey research increasingly faces two threats, declining response rates and limited financial support. Consequently, developing new and reliable data sources is of paramount importance. Using digitally derived data generated by respondent's normal activities offers a potential solution to concerns with existing data sources; this data is not dependent on recruiting willing subjects, does not typically require massive financial investment and may even allow better measures of respondent action and intention than self-report. In this paper, I test search engine databases, namely Google searches, for social research. I locate potential correlates of perceived sexual infidelity, a topic problematic for measurement in most survey research designs. To validate this new data source, these population level correlations are using individual data from the National Longitudinal Study of Adolescent Health, Wave 4. In addition to uncovering correlates of perceived infidelity, findings highlight the potential of search data as an exciting new tool.

Limitations of Survey Research

Social science research is commonly reliant on survey research as a means of data collection. Despite this role as a traditional workhorse of social science, the use of surveys to gather data, particularly in sensitive subjects, faces multiple concerns today. With these concerns, the need for additional sources and means of data collection in social science is acute.

Low response rates, though long a concern in survey research, are increasingly acknowledged by researchers. While response rates are remarkably high when compelled by federal law (the American Community Survey currently boasts a remarkable response rate of 97% of selected households), such compulsion is beyond the means of most researchers. Commonly used forms of survey administration, such as telephone, report lower response rates. Response rates to telephone surveys continue to decline in the United States, with recent years seeing an accelerating decline (Curtin, Presser, and Singer 2005). Researchers have reported response rates for telephone surveys involving cell phones to be under 20% in some cases (Lavrakas, Shuttles, Steeh, and Fienberg 2007). Even professional survey administrators have reported difficulties; Pew Research recently reported that current telephone surveys were recording only a 9% response rate (Pew 2012). This declining response rate for telephone surveys is perhaps unsurprising given current trends in the United States. Recent federal data found that 2% of U.S. households have no telephone service in their residence and more than 1 in 3 U.S. households do not have landline telephone service (Blumberg and Luke 2012). As adults continue to transition from traditional phone lines to cell phones as their primary or only form of telephone service, the population coverage of most telephone surveys will decline (Lavrakas 2010).

This telephonic discontinuation is particularly acute among certain population segments. Cell-phone use and ownership is disproportionately high among younger adults, renters, and lower income respondents (Blumberg and Luke 2007; Ehlen and Ehlen 2007).   Consequently, telephone administered surveys increasingly rely on the ever-shrinking pool of "old women without cell phones" (Shephard 2012). This reliance potentially threatens the generalizability of survey samples collected in this manner as the sample composition from telephone surveys differs from that of the target population.

Potential solutions to these problems exist; however, they generally entail additional costs. Cellular phone listings can be added to telephone based surveys, but this inclusion results in fewer working numbers, lower contact rates, more eligibility screening, and the necessity of financial compensation for cell phone minutes (Lavrakas, Blumberg, Battaglia, Boyle, Brick, Buskirk, DiSogra, Dutwin, Fahimi, Fienberg, Fleeman, Guterbock, Hall, Keeter, Kennedy, Link, Piekarski, Shuttles, Steeh, Tompson, and ZuWallack 2010). Taken together, these factors increase the cost for researchers collecting data via telephone survey.

Alternatively, high response rates may be achieved through in-person face to face surveys. A number of large surveys have consistently reported high response rates with this approach. Using in-person interviews, the General Social Survey (GSS) had a response rate of 70.6% in the 2010 data collection, the National Longitudinal Study of Health (Add Health) had a response rate of 80.3% in the most recent wave of data collection, and 80% of respondents in the NLSY79 agreed to participate in the 2000 survey.   However, such data collection in these large studies is typically quite expensive, with estimated costs exceeding $1,000 per respondent in

some cases, even with the economies of scale available in such large undertakings. Gathering responses from samples of non-trivial size, researchers are consequently reliant on securing external funding to mount this data collection.

Assuming the continued availability of funds for this data collection may be overly optimistic in the current financial and political climate. Budgeting constraints at the federal level in the United States, in addition to the recent recession, have led to various proposals potentially limiting available funding for scientific research. In the 2012 United States election, candidates proposed heavy cuts in sources that have traditionally funded social science data collection. In May of the same year, the U.S. House of Representatives voted to both defund the American Community Study and prohibit the National Science Foundation from funding political science research. Legislative action could similarly jeopardize other intensive, government sponsored research collections. Researchers must be prepared for the possibility that sources of funding for large scale research projects may not exist to the current extent in the near future.

In addition to these general limitations, surveys also face problems in collecting data on sensitive subjects, such as sexual behaviors. Since researchers began asking respondents about sexual behavior, there has been uncertainty over the accuracy of these reports. Self-reports of sexual behavior may be prone to measurement error in a number of regards: respondent refusal to respond, respondent not reporting behavior that they have engaged in, respondent underreporting behavioral frequency, respondent over reporting behavioral frequency, or respondent reporting of behavior that they have not engaged in (Catania, Gibson, Chitwood, and Coates 1990). Differences between male and female reported sexual behavior, while a commonly used tool to explore data quality (Schroder, Carey, and Vanable 2003), suggests an ongoing threat to measurement accuracy of sexual surveys. Chronic underestimation of normatively sanctioned sexual behavior is similarly suggestive of the limitations of survey self-reported sexual behavior. Surveys primarily rely on retrospective reports of sexual activity, which have well founded concerns surrounding the general recall of past events and self-report bias of sensitive topics (Schroder, Carey, and Vanable 2003). Taken together, despite improvements in the collection strategies of sexual behavior in surveys, the potential for meaningful measurement bias continues to exist.

Thus, both general and specific concerns face the continued usage of surveys to collect data on sexual behaviors. Generating sufficient response rate requires resources that whose availability cannot be assumed, and even if such undertaking is accomplished, we are uncertain of the quality of data that we have. Thus, we should consider the role and possibility for new, cost efficient methods of data collection to complement existing surveys. Such new data sources can serve many roles in social research: complementing existing survey research, informing new inquiries, and allowing less problematic measurement of sensitive topic.

Digital Data Sources

The increasing ubiquity of computers, social media and internet technology offers one such possible tool for social researchers. The proliferation of computer technology, from desktops to laptops to smartphones has led to a dramatic increase in the usage of online services. Over 76% of American households have a member that accesses the Internet (2009 CPS data). But this technology has spread beyond the office, with over 100 million smartphone in use in the United States, allowing almost ubiquitous Internet access to a large portion of the population.

One consequence of the widespread usage of online tools is the creation of new datasets. Purely by virtue of their digital activities and interactions, individuals create a new, archived digital data which is then is available for research.

Businesses and private groups have long taken advantage of the digital footprints that individuals leave. Companies like Facebook and Google rely on selling advertising images and clicks tailored specifically to the individual, making aggregation of observed online activity incredibly lucrative. Target uses digital records to build predictive models of individuals based on previous purchases. For example, given the value of capturing a shopper right before a child is born, data mining on shopping patterns has led to a model where pregnancy can be predicted from the purchase of items such as scented lotion and blue rugs (Duhigg 2012).

Though a more recent entrant to the field, academic researchers have begun to explore the potential of data compiled from day to day use of digital technology. Automated data collection, such as toll tag identification from automated toll roads has been used as an estimator of total economic production (Askitas and Zimmermann 2011b). Instances of mood description on Twitter have been used to predict stock market motion (Bollen, Mao, and Zeng 2011). Making use of an even larger data set, researchers have used search engine data to explore a number of topics. For example, one recent paper used Google search data to explore health behaviors and self-diagnosing (Askitas and Zimmermann 2011a). This usage of search engine data has the capacity to capture valid measures of intended concepts; for example, a study of joblessness using Google search terms correlated well with other measures of unemployment (McLaren 2011).

The use of digital records could also provide better measurement of sensitive topics, like sexual behavior, than survey questionnaires. Unobtrusive digital collection combines two key elements shown to increase the response rate and quality of sexual behaviors: anonymity and self-administration. Available search history data is stripped of identifying information, making it an anonymous data source. Respondents are more willing to respond to questions about sexual behavior in an anonymous setting (Durant, Carey, and Schroder 2002). As evidenced by the outcry following each small revelation to the contrary, individuals typically view their online interactions to be as anonymous as they would like. The sophistication required to track down even the most technologically naïve individual makes it reasonable to assume that individuals see their search history as more anonymous than a survey administered to them. Using digital records also allows the individual to have self-administered their own inquiries, which will increase the quality of data collected. In surveys, computer assisted self-interview (CASI), where the respondent replies to questions directly in the computer, is more effective in gathering information about sexual infidelity than direct response to an interviewer (Whisman and Snyder 2007). Using online records is a further extension of this development and should similarly benefit from the self-administered nature of the data.

Large scale observation of the daily thoughts, fears, dreams, and activities of huge swathes of the population provide insight into innumerable research interests. In addition, search record data is, in many cases, publicly available and free. Easy access to a large volume of information makes search engine histories an exciting new potential source of research data. This study will take advantage of archived Google search data to explore correlates of perceived sexual infidelity.

Perceptions of Partner Sexual Infidelity

Sexual infidelity is an important behavior, not just for the "unfaithful" partner, but for all individuals connected, both sexually and socially. Having additional sex partners increases the likelihood an individual will contract sexually transmitted infections such as human papillomavirus (HPV) (Javanbakht, Gorbach, Amani, Walker, Cranston, Datta, and Kerndt 2010) or bacterial based sexually transmitted infections (Kraut-Becher and Aral 2003). Concurrent sexual partnerships are important transmission means for HIV/AIDS (Kretzschmar and Morris 1996; Morris and Kretzschmar 1997), increasing the risk of disease contraction for the entire sexual network. Sexual infidelity is also a well-documented disruptor of relationships; clinicians traditionally view infidelity as one of the most damaging and difficult issues to treat (Whisman, Dixon, and Johnson 1997). It is estimated that 50-65% of the couples in clinical couples therapy are there, in part, due to marital infidelity (Glass and Wright 1988; Humphrey 1983).

Almost as, or in some cases, more, pernicious than infidelity is a person's perception of their partner's infidelity. In many cases, the concern is not whether a person cheated but rather whether a partner believes them to have. Afternoon television, music and personal anecdotes abound with stories of individuals doubting their partners' sexual fidelity. Entire shows are based on investigators or lie detectors determining whether a husband or wife is cheating on their marriage. Other shows rely on a continual parade of distrustful boyfriends and girlfriends and tearful confessions. In addition to these onscreen performances, an individual's perception of their partner's infidelity can influence behavior in a number of ways. In dating relationships, perceived infidelity can increase the likelihood of using contraceptives, like condoms (Lenoir, Adler, Borzekowski, Tschann, and Ellen 2006). Perceived infidelity, particularly on the part of the female, can trigger proprietary control or, in extreme cases, physical violence(Cousins and Gangestad 2007). In addition, perceived infidelity can trigger relationship dissolution, with all of the attendant secondary effects, as has been demonstrated in unmarried couples with children (Edin, England, and Linnenberg 2003).

Perceived partner sexual infidelity is a perfect topic with which to test the effectiveness of search engine databases as data sources. Because of the sensitivity of the topic, directly assessing this perception is difficult. By observing, rather than querying, information about partner infidelity, we also remove social desirability bias or implanted doubt from the measurement. Focusing on sexual infidelity, we may miss part of the population that is highly paranoid of discovery and therefore extremely conscious of "leaving tracks." The lack of symmetric consequences for partner infidelity suggests that there are fewer concerns over individuals purposively avoiding disclosure of this perception.

This paper will explore the potential for social research offered by search history databases. In particular, I will use data from Google Search to identify possible correlates of sexual infidelity. To demonstrate the value of this form of data collection, I provide both theoretical and empirical validation of findings from digital searches.

Data and Methods

Collection from the Google search database was accomplished in the following manner. With the focus on perceptions of marital fidelity, initial search strings of interest were "cheating husband" and "cheating wife". These strings were chosen for their known expectation of sexual

fidelity. In marriages, there is an almost universal expectation of sexual infidelity (Treas and Giesen 2000). While cohabiting unions have similar expectations (Treas and Giesen 2000), there exists no commonly used terminology to differentiate cohabiting partners from dating partners, where sexual exclusivity may not be assumed. To prevent findings being a consequence of my original phrasing, I entered these strings into Google Search Insights (http://www.google.com/insights/search/). This tool provides possible alternative phrasing for search terms, allowing me to examine similar concepts worded slightly differently. These strings returned the following similar search terms: is husband cheating, cheating on husband, my husband, my cheating husband, wife cheating, wife cheating husband, cheating signs, signs husband cheating, signs of cheating, catch husband cheating. Related searches to "cheating wife" were: cheating on wife, my cheating wife, is wife cheating, a cheating wife, cheating wife caught, and cheating husband. Removing searches related to searcher's, rather than partner's, infidelity and consolidating similar searches, the following search terms were used: cheating husband, is husband cheating, my cheating husband, signs husband cheating, catch husband cheating, cheating on wife, wife cheating, wife cheating husband, my cheating wife, is wife cheating, a cheating wife, cheating wife caught, cheating signs, signs of cheating.

Each of these search terms were individually entered into Google Correlate (http://www.google.com/trends/correlate/). This tool locates search terms with similar trend patterns to those entered. This pattern similarity can be assessed in either space or time. For example, searching for temporal correlations to the search term "Santa Claus" will yield search terms with similar patterns over time, like "Christmas" and "oh holy night." Correlations for each term were tested both temporally (monthly) and spatially (by US state). While it is also possible to test for correlations using search data aggregated by week, variation in search volume for these terms was insufficient to identify correlated search terms at this level. In many cases, search volume for a particular search was insufficient for Google algorithms to return similarly patterned search terms. For search term configurations with sufficient data to identify correlated terms (temporally: cheating husband, cheating wife caught, cheating signs; spatially: signs of cheating, cheating signs, cheating husband, cheating wife caught), the top 100 correlated terms for each seed term were extracted. Altogether, the final file included 700 search terms related to these searches about perceived or suspected partner infidelity.

The set of search terms was examined and terms were categorized by conceptual domain. For search terms with unclear meanings, the term was entered into Google Search (www.google.com) for additional information. Some search terms were not classified due to rarity, specificity, or incompleteness.

Following organization of search terms into conceptual domains, I sought to validate the findings from the digital database. This validation was accomplished in two ways. First, I identify theoretical rationale supportive of a correlation between perceived partner sexual infidelity and the observed conceptual domain. Second, I use data from Wave 4 of the National Longitudinal Study of Adolescent Health (Add Health) to test the associations observed in the Google search database.

The National Longitudinal Study on Adolescent Health (Add Health) is a nationally representative sample of more than 20,000 adolescents in grades 7–12 in 1994–1995 in the United States (Harris et al. 2009). The respondents were followed in three additional in-home interviews in 1996 (Wave II), 2001-02 (Wave III), and 2008 (Wave IV). Add Health is school-

based with the school sample stratified by region, ethnic mix, size, urbanicity (urban/suburban/rural), and school type (public/private/parochial). The Add Health data set provides a unique and, in many ways, ideal data set to further explore correlations identified using search engine data. The individuals in the data set are, as of the most recent wave of data collection, in their mid-20s to early 30s. Individuals in this age range are likely to be both heavily using computers and Internet based technology and dealing with cohabiting and marital relationships. This data set includes information about both sexual fidelity in the last or current relationship and perceived partner sexual fidelity. In addition, the large sample size, combined with variety of questions provides the power and range to explore a varied set of possible correlations.

Indicators for each conceptual domain identified in the Google analysis were compiled from available responses in Add Health. Correlations between these domains and perceived sexual infidelity were tested using the data from Add Health with two forms of statistical modeling. Perceived sexual infidelity is measured with a dichotomous indicator from the question "As far as you know, during the time you and <Partner> had a sexual relationship, has <Partner> ever had any other sexual partners?" Two sets of models were estimated to test the association between perceived partner sexual infidelity and the concept identified from Google search terms. First, bivariate relationships between perceived infidelity and the indicator of interest were estimated with logistic regression. This model tested whether the correlations observed at the population level in the Google data are also found at the individual level among Add Health respondents. A second set of models were estimated with multivariate logistic regression, to test the relationship between perceived infidelity and the conceptual domain, controlling for population composition factors. Included controls are age at the end/current point in the relationship, sex, highest education level attained, race, relationship duration, relationship type (marriage, cohabitation, or dating) and personal infidelity. These models allow me to test whether, in addition to identifying existing correlations, Google search data can add information to predictive models of perceived sexual infidelity All models using the Add Health data account for the complex survey design using the svy command in STATA 12 (StataCorp 2011).

Results

Eleven conceptual domains were constructed from the search terms identified by Google Correlate as having similar patterns as terms for perceived partner sexual infidelity. These domains were: physical appearance, video game playing, debt trouble, job hunting, pregnancy, health issues, drug usage, gun ownership, used cars, relationship status, and religion. Table 1 shows the search terms that comprise these groups. While the gendered nature of search terms (husband or wife or spouse) was not generally relevant, this was not the case with regard to measures of personal appearance; in this domain, women reported worrying about weight status while men reported concern over fitness and strength.

Theoretical Validation

Physical Appearance

While mate desirability is determined by a number of factors, one of the most important dimensions is physical attraction. Faced with contemplated or actual infidelity of a sexual partner, an individual may seek to re-establish sexual exclusivity by becoming a more desirable mate prospect than the alternative sexual partner. Therefore, to become more desirable to their partner, an individual can improve how attractive he or she is. Physical attractiveness is, of course, constructed by personal and cultural preferences and idiosyncrasies; however, there appear to be some common factors, especially for the current American context.

For women, while there is cultural variation with regards to weight distribution and acceptable weights (Cunningham, Roberts, Wu, Barbee, and Druen 1995), body mass index (BMI) is a powerful predictor of sexual attractiveness (Tovee, Reinhardt, Emery, and Corneilssen 1998). Men report intermediate (i.e. "healthy" weight) as the most attractive (Tovee, Reinhardt, Emery, and Corneilssen 1998), though women believe men desire them to be even thinner (Buss 2003). Given the prevalence of obesity among adults in the United States (Flegal, Carroll, Ogden, and Johnson 2002), improving a belief in improving attractiveness for women will commonly take the form of a belief in needing to lose weight.

For men, physical attractiveness has different signals. Women report finding men with broader shoulders, muscled chests and narrow waists attractive (Dixson, Dixson, Bishop, and Parish 2010; Horvath 1981) and men are aware of these preferences (Horvath 1981). We would anticipate that men who feel themselves deficient in this area would be more likely to perceive their wives as sexually unfaithful.

Thus, we would expect associations between perceived partner infidelity and beliefs about deficiency in physical appearance. It should also be noted that these correlations could be generated in the reverse direction. The degradation of an individual's appearance, from weight gain or poor exercise, leads them to be less attractive than other potential sexual partners, so they begin to worry about the sexual faithfulness of their partner.

Video Game Playing

Multiple pathways could link videogame usage to perceived partner infidelity. The association could arise from population composition. Individuals who play videogames are more likely to be young (over 70% are under 50 years old) and male (2011 Entertainment Software Association calculations), attributes linked to sexual infidelity and perceived infidelity. Video games, as potential competitors for shared time with a partner, could also be a source of relationship difficulty and dissatisfaction. Alternatively, an individual's excessive investment in video game playing could result in the partner seeking out additional sexual relationships.

Debt Trouble

Relationship difficulties can often be traced to life stressors to which the couple is exposed (Bradbury, Fincham, and Beach 2000). Finances are a common source of relationship difficulty and predict, among other outcomes, a couple's likelihood of divorce (Poortman 2005). In times

of economic uncertainty and trouble, there are pressures applied to the relationship, increasing the likelihood of partner sexual infidelity.

Job Searching

Similarly, unemployment is a stressful experience that can decay the social support provided by a marital partner (Atkinson, Liem, and Liem 1986). In addition to the general stress to the relationship, unemployment can reduce an individual's sense of self-worth (Clark, Georgellis, and Sanfey 2001). Taken together, we would anticipate that the unemployment experience could either lead to partner's infidelity or, by increasing insecurity, increase fear of losing a partner through sexual infidelity. Job searching could also be a product of sexual infidelity as sexual infidelity triggers relationship dissolution which leads to an individual establishing economic independence. Most of the job searches were in highly gendered female fields, such as nursing or education. As men are more likely to be engaged in sexual infidelity, the data could indicate female dissolution of the marriage and establishment of economic self-support.

Pregnancy

Pregnancy, controlling for other demographic factors, is predictive of male sexual infidelity (Whisman, Gordon, and Chatav 2007). Following child birth, marital satisfaction declines (Twenge, Campbell, and Foster 2003) and as satisfaction and relationship quality are predictive of infidelity (Allen, Rhoades, Stanley, Markman, Williams, Melton, and Clements 2008; Bell, Turner, and Rosen 1975; Edwards and Booth 1976; Greeley 1994; Plack, Kroger, Allen, Baucom, and Hahlweg 2010; Prins, Buunk, and Vanyperen 1993), this decline should increase the likelihood of sexual infidelity and consequently perception of the same.

Health Issues

Health problems, like economic trouble, can induce stress in a relationship (Bradbury, Fincham, and Beach 2000), resulting in degraded quality of the relationship. As individuals become more dissatisfied with the relationship, perceptions of either actual or potential infidelity of a partner increase. Previous work has found evidence of the relationship between an individual's health and their partner's attachment to the relationship. Among brain cancer patients, diagnosis of cancer leads to increased abandonment of a female partner by her husband almost double that observed in the general population (Glantz, Chamberlain, Liu, Hsieh, Edwards, Van Horn, and Recht 2009).

Drug Usage

Usage of illicit substances is associated with sexual concurrency (Adimora, Schoenbach, Bonas, Martinson, Donaldson, and Stancil 2002; Adimora, Schoenbach, and Doherty 2007). As both a relationship stressor and a primary risk factor, we would expect to find drug usage associated with not only sexual infidelity but also perceptions of a partner's infidelity as well.

Gun Ownership

While existing theories of gun ownership and orientation primarily focus on crime response or attitudes, there is evidence that mistrust and pessimistic outlook are also associated with gun ownership (Williams and McGrath 1976). In this vein, one study found that states with lower levels of trust, measured by mutual distrust and civic engagement, have higher rates of gun ownership (Hemenway, Kennedy, Kawachi, and Putnam 2001). If gun owners are more likely to distrust others than non-owners, then we would expect gun owners to be similarly distrustful of their partners' sexual fidelity. A bivariate analysis of the General Social Survey provides some support for this position, as there is a significant relationship between household gun ownership and views toward extramarital sex. Individuals with guns in the household report extramarital sex being more "wrong" than would be expected should the variables be independent.

Used Cars

The search for used cars is potentially indicative of economic troubles. As with debt concerns, this economic trouble could impose stress on a relationship. This stress could lead to degradation of the relationship, which could manifest as either distrust of a partner's fidelity or the partner actually engaging in an extramarital affair.

Religion

Many religions common to the United States have particular emphasis on sexual exclusivity in marital relationships. Among the observed search terms, many explicitly refer to the Christian faith. Within this religious tradition, views toward extramarital sexual relationships are outlined in both commandment ("*Thou shall not commit adultery*") and epistle form ("*Do not be deceived: neither the immoral, nor idolaters, nor adulterers… will inherit the kingdom of God*") form. Attention and importance to religious strictures could therefore be associated with greater attention to fulfilling this injunction.

Empirical Validation

The second validation strategy uses Add Health data to observe whether the correlations observed in the Google data also exist at the individual level. For each domain uncovered from search terms, I selected measures relevant to the concept. A complete list of variables constructed is available in the appendix material. However, some of the relationships could not be tested in the Add Health data. The association between recent pregnancy and perceived infidelity was not tested because the available measure of partner infidelity lacks a time reference and is therefore unable to be linked to a specific pregnancy period. As no measures of car ownership patterns were available in the data, the association between perceived infidelity and used car ownership was also not examined.

In the bivariate models (shown in the left column of Table 2), indicators of all concepts (except video game playing) were significantly associated with perceptions of partner infidelity. Observed significant associations were in the hypothesized direction. BMI, debts outnumbering

assets, unemployment, physical limitations, diagnosed illnesses and conditions (heart disease, diabetes, asthma, depression, PTSD), non-prescribed use of prescription drugs (sedatives, tranquilizers, stimulants, pain medicine), use of illegal drugs (marijuana, cocaine, crystal meth, other drugs, injected drugs, and frequency of marijuana usage), and having stabbed or shot someone in the last 12 months were all associated with increased likelihood of perceived partner sexual infidelity. In contrast, higher levels of income and church attendance are associated with decreased likelihood of perceiving the relationship partner to be sexually unfaithful.

Multivariate models (shown in the rightmost column in Table 2), including controls found a number of correlates still significantly associated with perceived partner infidelity. Controlling for these background factors, measures of five search identified domains are significantly associated with perceived sexual infidelity. High levels of church attendance are associated with lower likelihood of distrusting partner's faithfulness. Measures of employment (unemployed, unemployed but looking for work), health (general health, asthma, depression), drug usage (sedative misuse, tranquilizer misuse, stimulant misuse, marijuana usage, cocaine usage, methamphetamine usage, use of other illegal drugs, injecting drugs, frequency of marijuana use), and gun ownership (shot or stabbed someone in the last year) were associated with higher likelihood to perceive partner sexual infidelity.

Conclusions

Search engine databases have exciting potential as tools for social research. The volume and variety of data that is constantly collected about individual preferences and behaviors can serve an important research role. Particularly in the context of sensitive topics, like sexual behaviors and attitudes, the use of this data may provide an important addition to current data collection methods. This paper has demonstrated a possible use of this data for exploratory purposes. Using temporal and spatial correlations between search terms, I have located concepts that are associated with perceptions of a partner's infidelity. The concepts located in this manner were validated with two different tests. Theoretically, we would expect to find an association between these topics. We also discover correlations between these concepts and perceptions of partner infidelity in an empirical test using individual level data.

While it may seem that pulling search terms from an online database would only list common internet searches, there is evidence that meaningful information is extracted. Identifying search terms correlated with terms of interest found common repeated themes. Rather than a random assortment of possible internet searches, I uncovered repetition of similar concepts and ideas, albeit with variations in phrasing. The presence of these repeated concepts indicates that this analysis of search terms is capturing meaning and not just random noise.

Not only are there common concepts behind these search terms, but the identified concepts are related to perceived partner sexual infidelity. Theoretically, there are reasons to expect that each of the identified concepts from the Google searches would be also found at the individual level. In addition to this theoretical justification, there is empirical support that the identified search domains are related to perceived partner infidelity in the Add Health Data. Measures for seven of eight conceptual domains are correlated with perceived partner infidelity at the population level were similarly correlated at the individual level. These correlations are also in the direction suggested by theory and the located search terms. The sole unsupported domain is perhaps unsurprising given the close links between the internet and video games.

In addition to highlighting a new data source for social research, this paper adds to the existing literature on perceptions of a partner's sexual infidelity. The multivariate analysis tested whether the identified correlates allowed better prediction of perceived partner infidelity than basic individual characteristics. Finding significant associations, even after controlling for compositional factors like age and sex, suggest their importance for the study of sexual infidelity perceptions. Measures of health, drug usage, religious attendance and gun ownership were significantly associated with perceived partner infidelity in these models and should be included in future explorations of this topic.

Though this paper represents a first step in the usage of aggregate digital data, it highlights both concerns and possibilities for research in this area. While the existence and nature of error in social data is a topic of much research, digital data may provide unique challenges in this regard. The volume of data collected means that certain features of internet inquiry are likely to be represented. For example, despite the relatively theoretical justification and no empirical support, one of the most common search domains in the dataset was video game playing. Researchers should employ a healthy skepticism towards topics endemic to internet searches. The use of digital data also reinforces the importance of clarity of unit of analysis to avoid the ecological fallacy. The data used in this paper refer to population level associations involving perceived sexual infidelity of a partner. However, other sources may refer to different aggregates, such as the individual or the internet browsing session. Careful attention to both the unit on which the information is collected and to which the findings are being applied is required. Additional work on this particular source of data could take advantage of even more detailed information. In addition to identifying a correlation between a search term and the term of interest, Google Correlate reports the strength of this association. Future work could take advantage of this measure and potentially incorporate it into model expectations.

While many concerns face the continued use of surveys, both in general and in the specific case of sexual behavior, using online records is one possible solution. This paper shows that our reliance on survey data could be reduced in the future with the application of novel data sources. In specific circumstances, such as the study of sensitive topics or exploratory work, digital records provide an excellent source of data. That this free and easily accessible data source yields meaningful results consistent with findings from other data sources suggests that we should continue to imagine ways to make use of digital data.

Table 1:Google Searches Correlated with Perceived Partner Infidelity, Organized by Theoretical Domain

Topic	Search Terms	
Physical Appearance	Lose belly fat	Lose 40 pounds in 2 months
	Belly fat	Best diet pill
	Lose belly	How to lose belly fat
	Tone up	Getting into shape
	What foods not to eat	Power gym
	Belly fat loss	
	Insanity work out results	
Video Game Playing	Cheat code xbox	Codes for grand theft auto 4
	Need for speed pro street cheat	Cheat codes for grand theft auto 4
	God of war strategy	Cheat codes for midnight club
	Batman arkham asylum riddler challenges	Cheat codes for grand theft auto
		New mortal kombat
	Call of duty modern warfare 3 cheats	Codes for grand theft auto
		Cheat codes for call of duty
	Xbox 360 with Kinect bundle	The playstation 3
	Mario bros 3	Codes for xbox 360
	Burnout paradise cheat	Cheat codes for xbox 360
	Eq2 wiki	Cheat codes for
	Captain falcon	Ds lite pink
	Eq2 flames	Ps3 online games
	Space strategy games	
Debt Trouble	Loan lenders	Loans for bad credit
	Calculate car payment	Need a loan
	Homesite insurance company	Get a loan
	Krch realty	I need a loan
	Rental deposit return	Loan with bad credit
	Loans for students	Credit loans
	Free in nyc	Your credit score
	Conventional loan limits	Freecreditscore.com
	Citibank reo	Borrow money
	Penfed credit union	Credit card for bad credit
	Stay afloat	Interest rates on credit cards
	Citi reo	Cosigner
	Charles schwab mortgage	Eviction notice
	Loan limits	I have bad credit
Job Searching	Cover letter for resume	County government jobs
	Apply for job	Ny jobs
	Do you work	Jobs in dallas texas
	Hotels job	Preschool teacher jobs
	Sc jobs	Job link
	Teacher aide salary	RN positions
	Hisd jobs	Bank jobs

	Teacher assistant jobs	tn jobs
Pregnancy	Cause a miscarriage If your pregnant Baby at 5 months What is placenta Open cervix	Pregnant ultrasound Baby showers Pregnant symptoms Baby shower Pregnancy week by week symptoms
Health Issues	Lump in back Stomach nausea Hospitals in Portland Swollen vein Colonix cleanse Henderson mental health Leg twitching Swollen anus Collagen production Pulled chest muscle Exercises for carpal tunnel Right side chest pain Severe leg pain Depression remedies Biceps tendonitis Worms in humans Methicillin resistant staphylococcus aureus Symptoms of implantation	What is lupus Lower blood pressure Hurting Itching all over What are symptoms Upper respiratory tract infection Toe is numb Crabs pubic Swollen nipple Fingers swollen How do you get hiv Excessive coughing Over the counter medicine Discharge after period Pills Brain shrinkage Prednisolone acetate ophthalmic Sudden headache
Drug Usage	Ativan withdrawal Effects of drug use Symptoms of overdose	Clean dog urine Brick for sale (?)
Gun Ownership	5.56x45mm Little gun Ruger charger	Saiga ak-47 Tennessee carry permit
Cars-Used	2002 expedition 97 4runner All foreign auto Westside imports C10 truck Jeep grand Cherokee engine Hyundai santa fe 2008	Grand Cherokee 2001 Best pickup truck Toyota part number Toyota cars for sale Toyota camry pictures About Toyota Transmission leaks
Relationship Status	Marriage is over Getting a divorce	Get married Fix a broken heart
Religion	Praying hands Where in the bible What does the bible say about Where in the bible does it say What does the bible say	What is a god Holy bible Reap what you sow Bible scripture Psalms 23

	The holy bible Jesus said In the bible	Reap what you Jesus shirt

Table 2: Associations Between Google Search Identified Concepts and Perceived Sexual Infidelity in data from Add Health, Wave 4

Topic	Variable	Bivariate		Multivariate	
		B	SE	B	SE
Appearance	BMI	0.01**	0.00	0.00	0.00
	BMI (Women Only)	0.02***	0.00	0.01	0.01
	Perceived Weight (ref=1)				
	2	0.14	0.37	0.26	0.41
	3	-0.23	0.35	-0.01	0.38
	4	-0.14	0.36	0.04	0.39
	5	0.02	0.36	0.09	0.39
	Perceived Weight (ref=1)-Women				
	2	0.21	0.62	0.74	0.75
	3	-0.26	0.54	0.51	0.69
	4	0.00	0.54	0.66	0.70
	5	0.14	0.56	0.75	0.71
	Weight Lifting	-0.02	0.02	-0.01	0.02
	Weight Lifting (Men Only)	0.03	0.03	0.01	0.03
Video Game	Frequency Playing	0.01+	0.00	0.00	0.00
Debt	Total Income	-0.00*	0.00	0.00	0.00
	Total Income (ref=<$5,000)				
	$5,000-9,999	0.02	0.28	0.07	0.30
	$10,000-14,999	-0.11	0.39	0.06	0.38
	$15,000-19,999	-0.20	0.36	-0.14	0.37
	$20,000-24999	-0.52+	0.30	-0.36	0.29
	$25,000-29,999	-0.55+	0.31	-0.27	0.31
	$30,000-39,999	-0.43	0.34	-0.16	0.33
	$40,000-49,999	-0.76*	0.31	-0.36	0.30
	$50,000-74,999	-0.75*	0.32	-0.35	0.31
	$75,000-99,999	-1.06**	0.33	-0.50	0.32
	$100,000-149,999	-1.02**	0.34	-0.52	0.32
	$150,000 or more	-0.84*	0.34	-0.40	0.35
	Total Debt (ref=<$1,000				
	$1,000-4,999	0.15	0.12	0.16	0.12
	$5,000-9,999	-0.01	0.14	0.03	0.15
	$10,000-24,999	0.01	0.13	0.17	0.14
	$25,000-49,999	-0.17	0.14	-0.09	0.15
	$50,000-99,999	-0.06	0.16	0.04	0.17
	$100,000-249,999	-0.37*	0.17	-0.03	0.18
	$250,000 or more	0.05	0.27	0.10	0.31

	Debt/Asset (ref=Assets>Debt)				
	Assets=Debt	0.24**	0.08	0.07	0.09
	Debt>Assets	0.37***	0.08	0.16+	0.09
Employment	Current Employed	-0.05	0.07	0.04	0.06
	Unemployed+Looking	0.59***	0.12	0.28*	0.13
	Unemployed Generally	0.55***	0.11	0.27*	0.13
Health	General Health (ref=Excellent)				
	Very Good				
	Good				
	Fair				
	Poor				
	Health Limits Activity (ref=No)				
	Some Limitation	0.38**	0.11	0.29*	0.11
	Lots of Limitation	0.37+	0.19	0.35+	0.21
	Stair Climbing Limit (ref=No)				
	Some Limitation	0.24	0.15	0.16	0.17
	Lots of Limitation	0.46*	0.19	0.40*	0.20
	Skin Cancer	0.01	0.29	-0.32	0.30
	High BP	-0.09	0.12	0.14	0.14
	Heart Disease	0.19*	0.09	0.11	0.10
	Migraines	0.16	0.19	0.11	0.22
	High Cholesterol	0.46	0.37	0.25	0.37
	Diabetes	0.19*	0.08	0.15	0.10
	Epilepsy	0.13	0.09	0.05	0.09
	Asthma	0.51***	0.09	0.33***	0.10
	Depression	0.56***	0.13	0.36*	0.16
	PTSD	0.30***	0.09	0.18+	0.11
	Anxiety	0.26	0.24	0.21	0.24
Drugs	Prescription-Sedatives	0.55***	0.09	0.35**	0.11
	Prescription-Tranqs	0.53***	0.11	0.40***	0.12
	Prescription-Stimulants	0.46***	0.11	0.38**	0.13
	Prescription-Pain Meds	0.34***	0.10	0.24*	0.10
	Steroids	-0.10	0.18	-0.15	0.21
	Pot	0.33***	0.06	0.16*	0.06
	Cocaine	0.41***	0.07	0.32***	0.08
	Meth	0.62***	0.10	0.47***	0.10
	Other illegal drugs	0.32***	0.09	0.27**	0.10
	Injecting Drugs	1.09***	0.31	1.19**	0.39
	Pot Frequency (Month)	0.11***	0.01	0.04*	0.02
	Pot Frequency (Year)	0.09***	0.02	0.01	0.02
Church	Christian	-0.11	0.08	-0.05	0.09

	Church Attendance (ref=None)				
	Few Times	-0.13+	0.07	-0.18+	0.09
	Once a Month	-0.03	0.12	0.00	0.13
	2-3 times a Month	-0.37**	0.13	-0.41**	0.14
	Once a Week	-0.41***	0.11	-0.34**	0.13
	More than Once a Week	-0.27	0.16	-0.23	0.19
Guns	Shooting/Stabbing	0.29*	0.14	0.25*	0.12

Appendix:

Indicators for each domain

Topic	Add Health Variables
Physical Appearance	BMI (women)
	Perceived Weight Status (women)
	Weight Lifting (men)
Video Game Playing	Frequency of Video Game Playing
Debt Trouble	Total Income
	Total Debt
	Debts Exceed Assets
Job Searching	Currently Employed
	Unemployed and Seeking a Job
Health Issues	General Health
	Miss Days of Work
	Health Limits Activity
	Stair Climbing Limited by Health
	Has Skin Cancer
	Has High Blood Pressure
	Has Heart Disease
	Has Migraines
	Has High Cholesterol
	Has Diabetes
	Has Epilepsy
	Has Asthma
	Has Depression
	Has PTSD
	Has Anxiety
Drug Usage	Prescription-Sedatives
	Prescription-Tranqs
	Prescription-Stimulants
	Prescription-Pain Meds
	Steroids
	Pot
	Cocaine
	Meth
	Other illegal drugs
	Injecting Drugs
	Pot Frequency (Month)
	Pot Frequency (Year)
Gun Ownership	Shoot or Stabbed Someone
Religion	Christian
	Church Attendance Frequency

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