Title

Allegations of Affection: The Impact of Rumored Ties on Short Cycles, Node Sexuality, and Age-Gapped Pairings in a Celebrity Romantic Relationship Network

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Allegations of Affection:

The Impact of Rumored Ties on Short Cycles, Node Sexuality, and Age-Gapped Pairings in a Celebrity Romantic Relationship Network

A dissertation submitted in partial satisfaction of the

requirements for the degree Doctor of Philosophy

in Sociology

by

Carmella Nicole Stoddard

2024

ABSTRACT OF THE DISSERTATION

Allegations of Affection:

The Impact of Rumored Ties on Short Cycles, Node Sexuality, and Age-Gapped Pairings

in a Celebrity Romantic Relationship Network

by

Carmella Nicole Stoddard

Doctor of Philosophy in Sociology

University of California, Los Angeles, 2024

Professor Gabriel Rossman, Chair

Using a novel dataset of sexual and romantic celebrity relationship histories from whosdatedwho.com, I conduct a 3-part analysis of how rumored ties highlight counter-normative behavior and violate structural network heuristics. Rumored ties about celebrities are produced within social exchanges as a hybrid of gossip and rumor and are useful for highlighting counter-normative behavior violating expected tie formation. I define gossip and rumors and situate discussions about celebrities as a hybrid form of these related concepts. I explain the implications of gossip and rumor's ability to transmit information about normative violations when these claims are modeled as network ties. Finally, I discuss age gap norms and how these

vary based on relationship context and age-gender pairings (e.g., older man-younger woman, etc.).

Analysis 1 examines the structural impact of rumored ties in the context of short cycle and sexuality norms in heterosexual networks using Random Tie Deletion Resampling (RTDR; a combined social network analysis and bootstrapping method). Rumored tie inclusion increases short cycles, increases bisexual nodes, and decreases overall network sexuality. Analysis 2's motif analysis identifies common gender, edge sexuality, and rumored tie combinations. Female bisexuality is key to short cycle construction and rumored ties usually occur as just one edge within these structures. Analysis 3 examines age gaps and variation in age gaps by relationship type and older partner's gender. Rumored ties are strongly associated with short-term relationships and older women's involvement. Hence, rumored ties violate specific norms for age gaps, "over-closeness" in short cycles, and "discordance" in sexuality.

I discuss my findings within a framework of rumors and gossip as statements built from competing concerns about recognizability, plausibility, and salaciousness. I explore this framework by examining age gaps and zodiac incompatibility as similarly plausible occurrences with varying normative recognizability. Rumored ties are more associated with more recognizable age gap norms than less recognizable zodiac norms. My findings indicate gossip and rumor actively balance the recognizability, plausibility, and salaciousness of rumored tie claims. Thus, rumored ties matter as they shape network structures, illustrate norms, and illuminate how we assess and perceive counter-normativity in exchanges of gossip and rumor.

The dissertation of Carmella Nicole Stoddard is approved.

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2024

DEDICATION

This dissertation is dedicated to the version of me who arrived here suddenly in late May 2015.

Look at what you survived and how far you've come.

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CHAPTER 1

Introduction

Despite denying any attraction to women in her 1954 autobiography (Monroe 2007:93-94), posthumous chatter circulated about Marilyn Monroe's liaisons with other female actresses such as Marlene Dietrich (Thornton 2012). This purported connection is intriguing on its own as it implies an otherwise straight woman dabbled in same-gender relationships, but it is even more salacious considering Monroe's partnership history. Monroe had a brief tumultuous marriage to former New York Yankee Joe DiMaggio from 1952-1955 (Heymann 2014). Several years earlier, DiMaggio hooked up with Dietrich after a night out with singer Frank Sinatra (Heymann 2014:16). The rumored tie between Monroe and Dietrich creates a triad violating a normative expectation to avoid pairing with anyone relatively close to yourself due to overlap in ex-partnership histories (Bearman, Moody, and Stovel 2004). It's debatable whether the alleged Monroe-Dietrich affair is true or simply meant for titillating gossip. Relationship links can, and often do, exist only as rumored ties. Yet, social network analysis of romantic and sexual relationship networks usually deals with self-nominated ties confirmed by at least one person in the couple. This may be because rumored ties from third-party sources are seen as less reliable or lower quality data compared to self-nominated ties, but the former may be important for how individuals conceptualize network activity and investigations of rumored ties and their structural impact are merited.

This dissertation focuses on the distinctive role of rumored ties in celebrity relationship networks. I argue that because rumored ties about celebrities can be produced within social exchanges as a hybrid of rumor and gossip (DiFonzo and Bordia 2007:28; Rosnow 2001:211; Fine 1985), they are useful for highlighting counter-normative behavior and violations of expected tie formation heuristics. I start by defining gossip and rumors and then situate discussions about celebrities as a hybrid form of these related concepts. I then explain the implications of gossip and rumor's ability to transmit information about normative violations when these claims are modeled as network ties. Before conducting my analyses, I delve into more specific norms concerning age heterophily (or age gaps) in relationship ties and how these expectations vary depending on age-gender pairings (e.g., older male partner, older female partner, etc.).

For my first analysis, I examine the relationship between rumored ties and network heuristics using a novel dataset of celebrity relationships and Random Tie Deletion Resampling (RTDR), a methodological approach combining network analysis and bootstrapping. RTDR measures changes in network parameters using *z*-scores comparing values observed when a specific subset of ties are completely removed to a distribution of values from networks wherein the same number of ties are randomly deleted. I use RTDR to examine the structural impact of rumored ties in the context of normative expectations regarding short cycles and sexuality for heterosexual relationship formation. In my second analysis, I conduct a motif analysis to determine the most common combinations of gender, edge sexuality, and rumored ties for a descriptive understanding of network short cycles. In my third and final analysis, I focus on age gaps as another site of counter-normativity in tie formation and examine how age gaps vary depending on relationship context and gender of the older partner. After reviewing analytic results, I discuss my findings within a framework of rumors and gossip as statements drawing on competing concerns of recognizability, plausibility, and salaciousness. I argue that these three factors interact to influence conceptualizations of counter-normative behavior and the construction of rumored ties. I attempt to tease out this theoretical framework for rumored relationship claims by examining age gaps and zodiac incompatibility as similarly plausible norms with varying recognizability. In sum, my analyses highlight how rumored ties matter as they shape network structures, illustrate norms, and illuminate how we assess and perceive counter-normativity in exchanges of gossip and rumor.

CHAPTER 2

Literature Reviews and Hypotheses

2.1 Analysis 1-2

2.1.1 Gossip as informative, evaluative, and entertaining social exchange

Often regarded as "idle talk" (Foster 2004), gossip is "candor at other people's expense" (Aristides 1990:11) or a "general interest" in the doings, virtues, and vices of others (Gluckman 1963:308). Gossip is nearly universal and is present in some form across: age groups (Baumeister, Zhang, and Vohs 2004:114-115,116), genders (Baumeister et al 2004:114; Dunbar, Duncan, and Marriott 1997), personal and professional settings (Dunbar et al 1997; Sun, Schilpzand, and Liu 2022), cultures (Ingram 2018), and historical eras (Epstein 2012). Although traditionally done during face-to-face verbal exchanges, digital and mass media technology allow us to gossip about others well outside our network boundaries (Fine and Rosnow 1978:162; Levin and Kimmel 1977).

Gossip is generally defined as the evaluative discussion of an absent third party and their social actions (Foster 2004:80-81). Gossip usually focuses on the personal sphere (DiFonzo and Bordia 2007:27) and intimate details of the absent third party's life (Foster 2004:80). Some definitions reference present third parties (Dunbar et al 1997), but the general layman's understanding of the term is usually reserved for exchanges about someone absent from the discussion (Foster 2004:81-82). Additionally, these exchanges may be positive or negative (Foster 2004:82), but most definitions of gossip generally concern discussants trading negative assessments about others (Bergmann 1993:102; Morreall 1994:59). In addition to providing information about others (Foster 2004:82-83), gossip serves multiple purposes as an informative, evaluative, and entertaining interaction reinforcing social norms.

First, gossip is informative because it helps participants establish a working consensus and reach some level of agreement about how to regard the absent person and their alleged behavior (Yerkovich 1977:195). This working consensus informs participants about associated norms and interaction scripts built from shared rules (Baumeister et al 2004:113) relevant to the behavior in question. Gossip may even be viewed as permissible or beneficial if it arises in response to or details actions violating normative expectations (Baumeister et al 2004:112; Feinberg et al 2012). Moreover, when gossip involves claims about flaws, inconsistencies, or improprieties in a third party's character or behavior (Bergmann 1993:126-127), it draws attention to potentially counter-normative actions violating social expectations (Bergmann 1993:128; Feinberg et al 2012). If the referenced flaws, inconsistencies, or improprieties amount to some moral failing, then this establishes negative exemplars of acceptable behavior (Bergmann 1993:128; Robinson 2016). Thus, the consensus building in gossip exchanges clarifies an informative "definition of the situation" (Goffman 1959:13,238-239; see also Bilinović Rajačić, Kišjuhas, and Śkorić 2020:565) and allows for the establishment and maintenance of social norms and social control (Baumeister et al 2004:113-114).

Gossip also allows participants to engage in positive or negative (Fine and Rosnow 1978:162) evaluative exchanges of meaningful information about others and their behavior (Foster 2004:82). What this means is that in addition to trading social and personal updates, gossip also involves sharing some "value-laden information" (Noon and Delbridge 1993:25) which establishes and reinforces normative expectations (Alfano and Robinson 2017:476; Wert and Salovey 2004:128-129). Even if the explicit goal is simply comparing observational notes, normative expectations may be invoked as gossip often invites participants to engage in social comparison by evaluating a target and their compliance with social rules (Robinson 2016:2; Wert and Salovey 2004:123,126).

Finally, gossip entertains (Foster 2004:85) as it "undeniably gives thrill and excitement" (Chua and de la Cerna Uy 2014:66). It is often "amusement for amusement's sake" (Foster 2004:85), but this entertainment factor does not mean it is always comedic or frivolous. Think of the silent brow raise, knowing nod and wink, or bemused chuckle sent from one in-group member to another while witnessing a social misstep. This mutual recognition of misconduct allows recognition of shared interpretations of established norms (Wert and Salovey 2004:124,126). Likewise, the insider information required to "get" gossip furthers bonding and group belonging (Gluckman 1963:309; Wert and Salovey 2004:128) while entertaining those in the know. Once some degree of consensus is reached, gossip gives participants a chance to evaluate others while amusing themselves (Foster 2004:85). Participants' evaluations may further enact social control if these assessments invoke additional sanctions (Baumeister et al 2004:115; Foster 2004:83). Thus, gossip is deceptively trivial as the entertainment value of judgmental whisperings often disguises how efficiently these statements reinforce normative expectations.

2.1.2 Rumors as informative, valuable, and interesting social discourse

Whereas gossip can be defined as encompassing a general communication act in social interaction (DiFonzo and Bordia 2007:25,27-28), rumors are often conceptualized as specific statements about social entities (DiFonzo and Bordia 2007:23,28). Both forms can be transmitted from person to person via word-of-mouth exchanges (Allport and Postman 1947:ix), but rumor is traditionally defined as being propagated on a larger or more public scale (Pendleton 1998:69-70). Additionally, gossip is more frequently based on direct observation or knowledge of a third party's character (Emler 1990:133) and may "have a higher degree of 'factuality'" (Mills 2010:214). Rumors on the other hand may be based on assumption and inference and often contain unconfirmed and weakly corroborated claims (DiFonzo and Bordia 2007:24). Yet, despite a potentially questionable basis in truth rumors may still be informative, valuable, and interesting discourse reinforcing social norms.

First, rumors may be informative as they reiterate the boundaries of everyday morality (Sabini and Silver 1982) and thus illustrate the expected codes of conduct reinforcing social norms. Similarly, responses to rumored actions may be crucial for enacting and enforcing social sanctions for real or perceived transgressions (Adut 2009). When subjected to sanctioning for presumed transgressions, one's social reputation may be altered or destroyed entirely even if the rumor itself is unproven (Adut 2009:21). Although the impact on the subject is generally negative because it involves some loss of status, positive side effects may result if sanctioning initiated by rumors improves participants' decision-making (Baumeister et al 2001). This is especially the case if sanctions discourage others from engaging in similarly anti-social, aggressive, or aversive behavior (Orstrom, Gardner, and Walker 1994). Thus, by calling attention to, demanding evaluation of, and prompting sanctions for transgressions, rumors inform a general conceptualization of social norms and everyday morality (Sabini and Silver 1982).

Some rumors are simply slanderous accusations (Rosnow and Fine 1976:123-129) or arise when information is lacking, but speculation abounds about the suspicious nature of events (DiFonzo and Bordia 2007:19-20). In either case, a rumor may be valuable if it helps "make collective sense in an ambiguous situation" (DiFonzo and Bordia 2007:21). Moreover (and as is also the case in gossip), the importance of a rumor's content is defined by interested parties disseminating the claim (Allport and Postman 1947:502; Pendleton 1998:70). This means that a rumor may be viewed as worth repeating even when its contents are not well-established fact because it mitigates ambiguity (Peterson and Gist 1951:159) by identifying or describing a normative violation. Deciding whether or not an action contradicts norms is still possible even when familiarity with a target is low (Yerkovich 1977:196), but this should necessarily increase the value of information gathered about others from rumors (Mills 2010:214-215). This is because counter-normative allegations communicate relevant information about social expectations, reputation, and other important resources (Emler 1990:133). It is in this way that rumors about infractions may be equally, if not more, valuable than discussions of action abiding by social norms (Baumeister et al 2001).

Lastly, rumors may be interesting if the exchanged information fills in any gaps necessary for constructing the moral characterizations of prominent or high-status people. This information would be particularly interesting as first-hand experience or personal acquaintance with high-status or prominent individuals is often fairly limited (Kurzman et al 2007:356). Although this limits direct observation of notable people's behavior, it would not necessarily decrease the frequency of others' normative evaluations of them. Additionally, being prominent within a community allows those not personally acquainted with that person to easily and frequently formulate rumors about them (see for example the Paul McCartney death rumors, Rosnow and Fine 1976:14-17). This phenomenon is further aided by the increased use of mediated communication, the Internet, social media, and sensationalist news outlets focusing on the lives of prominent individuals such as celebrities, royalty, and athletes (Friggeri et al 2014). Similarly, information related to sex and sexuality is interesting as it is a useful indicator of reproductive fitness, status, and morality (Davis and McLeod 2003). These latter three concerns may factor into social interactions and normative evaluations of others and become highly salient topics of discussion. Thus, rumors focusing on either high-status or prominent individuals or sex and sexuality may be regarded as interesting and occur fairly frequently.

2.1.3 Chatter about celebrities as a hybrid form of gossip and rumor

Information about either high-status individuals or highly salient topics like sex and sexuality are interesting in their own right. But, when these themes appear together it may result in especially fascinating tidbits (Darnton 1995). Concern with high-status social alters and sex is present even in lower primates like rhesus macaques (Deaner, Khera, and Platt 2005). A macaque's willingness to "pay" to view photos of higher-status macaques or fertile female macaques is notably similar to the human urge to flip through glossy magazines detailing the sordid sex lives of celebrities. This curiosity is not limited to contemporary times and was similarly present in historical rumors about the alleged sexual improprieties of royalty such as Henry III's bisexuality (Crawford 2003:513-514), Russian Czarina Alexandra's extramarital affair with the abnormally endowed Grigori Rasputin (Shaw 2002:183), or Queen Elizabeth I's illicit liaison with Englishman Robert Dudley, Earl of Leicester (Levin 2013:78-79,89). In these historical instances, rumors about disreputable proclivities were sometimes part of broader character assassination campaigns to undermine a sitting royal's legitimacy (Crawford 2003:516,532; Levin 2022:242), which arguably makes them functionally more similar to defamation or even sedition. Political machinations aside, these scandalous accusations created rumored connections that were widely regarded as violating normative expectations and prevailing constructions of moral sexuality (Hunt 1993). As the prevalence and political power of monarchies decreased and as the prominence of modern mass media grew, public interest in and rumors about the lives of high-status others has shifted from royalty to notable figures in the entertainment industry (Drake and Miah 2010; Kurzman et al 2007:352-354). What has remained fairly consistent is the use of rumors as a combined source of information about high-status others and highly salient topics like sex and sexuality (Davis and McLeod 2003).

Typologically speaking, categorizing claims about celebrities and notable figures as either gossip or rumor reveals blurry boundaries for this form of social discourse (DiFonzo and Bordia 2007:28). DiFonzo and Bordia (2007:20) highlighted context, content, and function as three facets of social discourse for distinguishing between rumor and gossip. Gossip is usually contained in the private sphere, focuses on personal information about social confidantes, and primarily functions to entertain, inform, or bond participants (Foster 2004:83-86). Rumor, however, is conceptualized as publicly exchanged information that aims to warn others or reduce ambiguity about more generalized threats (DiFonzo and Bordia 2007:20-21). Given that they often focus on personal or intimate details (as in gossip; Foster 2004) while publicly proposing hypotheses, "allegations or attributions based on circumstantial evidence" (as in rumors; Pendleton 1998:70), claims about celebrities and notable figures exist as a somewhat hybrid form of gossip and rumor (DiFonzo and Bordia 2007:28; Fine 1985; Rosnow 2001:211). These statements may be offered as evaluative talk (as in gossip; Foster 2004) or interpretations mitigating uncertainty associated with a "problematic situation that the general public considers to be emotionally-charged" (as in rumor; Pendleton 1998:71). It is closer to gossip when information is exchanged between celebrities themselves, their public relations teams, or directly transmitted to news outlets, but it shifts into something closer to rumor once claims begin circulating in the general public. Moreover, alleged relationship ties may fall within the category of "idle rumors" (Allport and Postman 1947:vii) as "an unverified, casual type of discourse serving no purpose other than" (Allport and Postman 1947:vii) interpersonal bonding. Thus, this conceptual subset could simultaneously maintain gossip's micro-level enforcement of norms within smaller groups (Baumeister et al 2004:119) alongside rumors' macro- or meso-level communication of matters of "public" interest (DiFonzo and Bordia 2007). Moreover, interest in these claims may depend on a participant's need for social connection (Currid-Halkett 2010:17-22) or the degree of parasociality between onlookers and celebrities (Barron 2014:100). When this hybrid form concerns romantic or sexual relationships, it makes sense to expect that referenced ties will retain some functional characteristics of gossip in terms of normative evaluations even as they take on and use the dissemination format of rumors. To the extent that they invoke normative expectations, rumored ties in celebrity romantic and sexual relationship networks may also be associated with structural expectations for tie formation.

2.1.4 Rumored ties and structural heuristics in romantic and sexual relationship networks

If gossip and rumors transmit information about normative violations, then these should inversely highlight structural heuristics or expected patterns of tie formation. We can think of the exchanged information as creating a "rumored" network tie when these claims create links between targeted individuals. For instance, speculation about a married person's affair creates an alleged connection between them and an extramarital partner which could be represented as a rumored relationship tie. If there is an implied normative violation, then the inverse of the alleged behavior may represent a contextually salient expectation for tie formation. In this example, the normative violation is having relationships involving both marital and extramarital partners. Thus, the implied tie formation pattern violated is the expectation to avoid having multiple partners during overlapping periods when at least one of those ties has explicit monogamous expectations. From here, we can inversely infer the specific structural pattern violating the expected tie formation heuristic. A prohibition on having multiple partners when one tie is explicitly monogamous is equivalent to an isolated dyad with no concurrent ties to third parties. In the network as a whole, we would expect isolated dyads to less frequently involve concurrent relationship ties with third parties. Thus, the structural patterns imposed by tie formation expectations contribute to more widely maintained network heuristics indicative of prevailing normative expectations. If gossip or rumor exchanges frequently involve claims about normative violations and thereby frequently imply expected tie formation patterns, then we may be able to infer underlying network heuristics that should be more frequently violated by rumored ties. Existing network studies provide valuable context for structural heuristics potentially highlighted by rumored relationship ties.

2.1.4.i Short cycles and "over-closeness"

One key network heuristic for some romantic and sexual relationship ties is avoiding "short cycles" involving an ex-partner and an ex's ex-partner(s) (Bearman, Moody, and Stovel 2004:74). When represented as a path (i.e., a list of nodes and the edges or ties between them) cycles begin and end with the same node and pass through each edge only once (Jackson 2008:24). The length (*k*) of the cycle indicates the geodesic distance between an individual and themself within the cycle (Jackson 2008:24). In a dating network with only opposite-gender ties, the shortest cycle possible involves four nodes and is called a "4-cycle." Figure 2.1 illustrates a 4-cycle with current ties in black and former ties in gray. In this illustration, Adam divorced Ariana and married Blair. The newly single Ariana then married Blair's ex-husband Bryson. We can travel from Adam and back to himself in four steps due to the linked relationships with his current partner (Blair), past partner (Ariana), and his current partner's ex-partner (Bryson).

Even shorter cycles involving only three nodes are possible when same-gender ties are included. These "3-cycle" structures can involve only same-gender ties (an entirely homosexual cycle) or a combination of same- and opposite-gender ties (to create a mixed heterosexual, homosexual, and bisexual short cycle). Figure 2.2 shows a 3-cycle in which Ariana and Bryson each dated Caitlin (gray ties) before their relationship (black tie). The Ariana-Bryson and Bryson-Caitlin ties are both opposite-gender, while the Ariana-Caitlin tie is same-gender.[1] Again, we can go from Adam and back to himself in three steps via the linked partnerships within this structure.

-- FIGURE 2.1 AND FIGURE 2.2 ABOUT HERE --

Short cycles are beneficial when the diffusion of information, resources, or communication depends on the connectedness of these network structures (Jackson 2008:92). In romantic and sexual networks, however, being able to go from oneself and back in a handful of steps means being included in a cycle with an ex-partner, their current partner, or their current partner's ex (Bearman et al 2004:73). If there is a normative expectation to avoid this kind of "over-closeness," then it should show up as few to no short cycles. This means acyclicity or an overall lack of cycles is the network heuristic. Inversely, if "over-closeness" is tolerated, then short cycles should occur frequently and dating networks should have pronounced cyclicity. As illustrated by the literature, sexual relationship networks are sometimes characterized by acyclicity (Fichtenberg et al 2009:44; Ghani et al 1996:500,501; Marcum, Lin, and Koehly 2016), which translates to a spanning tree structure resembling the network layout shown in Figure 2.3. The large diameter and acyclicity of a spanning tree place individuals at a distance from exes of past or current partners such that going from themselves and back requires more than a few steps or passing through the same nodes and edges multiple times. Thus, no one is "overly close" to themself or their ex-partners. Variations of the spanning tree structure have also

[1] It should be noted that a 3-cycle is different from a "love triangle." A 3-cycle is a closed triad whereas a love triangle is an open triad in which two suitors seek the romantic interest of the same target individual (i.e., the two peripheral nodes are rivals and not former lovers; Emerson 1962).

been found. Bearman and colleagues (2004:59) identified a "chainlike" spanning tree structure similar to the network in Figure 2.4. This variation has one large connected component containing the majority of network nodes. As in the spanning tree, there is notable acyclicity and the network has few short cycles.[2]

-- FIGURE 2.3 AND FIGURE 2.4 ABOUT HERE --

The network heuristic of few to no short cycles has been interpreted as being associated with an underlying norm against "over-closeness." Violations of this norm result from dating an ex-partner's exes (creating 3-cycles as in the example from Figure 2.2). This similarly implies an underlying norm against "over-closeness" resulting from dating exes of your ex's current partner (creating 4-cycles as in the example from Figure 2.1). This does not necessarily tell us *why* network actors avoid short cycles – only that they may often opt to do so. Regardless of the underlying reasoning, short cycle aversion may be a clue to what network observers consider interesting fodder for gossip and rumors. If (a) the implied norm is avoiding "over-closeness" and (b) gossip and rumors often involve claims about normative violations, then (c) rumored relationship ties should frequently violate this expectation and be associated with a higher number of network short cycles. If rumors and gossip about dating networks more frequently violate the expectation to avoid "over-closeness," then rumored ties should occur more frequently in short cycles that result from ignoring this norm. Thus, I hypothesize that:

[2] Bearman et al (2004:74) also noted fixed degree and homophily based on dating experience as additional conditions producing the "chainlike" spanning tree structure at Jefferson High. However, limitations on degree necessarily reduce (albeit do not eliminate, see Moody et al 2003) network openings for short cycles. The authors additionally attributed short cycle avoidance to more general angst about potential status loss associated with "over-closeness" (Bearman et al 2004:75).

H1: Rumored ties should be more likely to occur in short cycles of length 4 such that 4-cycles are more numerous when rumored ties are present.

Similarly, the norm against "over-closeness" may be associated with networks having relatively few 3-cycles. My second hypothesis follows the logic of Hypothesis 1 about rumored ties and 4-cycles. In this case, violating expected short cycle avoidance may mean that:

H2: Rumored ties should be more likely to occur in short cycles of length 3 such that 3-cycles are more numerous when rumored ties are present.

2.1.4.ii Discordant ties and sexuality

Gossip and rumors often involve exchanges of valuable and socially relevant information about sex, sexuality, and norms surrounding these topics. Perspectives on the origin of sexuality and sexual orientation primarily fall into two camps. One camp views sexuality and sexual orientation as either genetically or biologically determined from birth (Edwards and Brooks 2011:51). The other camp sees these characteristics as developing in response to social and cultural interactions (Edwards and Brooks 2011:52). In line with these perspectives, it is often presumed that individuals will have fairly stable patterns of sexual desire and attraction (Dillon, Worthington, and Moradi 2011:653). These patterns are then interpreted as expressions of sexual orientation or sexuality (Dillon et al 2011:653). If sexuality is stable and reflected in dating relationships, then partner choice patterns should also be fairly consistent.

Furthermore, what is implied if sexuality and partner selection are stable over time is that each node has its own heuristic for tie formation. The most common individual-level heuristics are straight nodes with an opposite-gender tie heuristic, gay or lesbian nodes with a same-gender tie heuristic, and bisexual nodes with a tie heuristic for both opposite- and same-gender ties. Ties following these heuristics are expected to be consistent with the rest of a node's partnership history such that relationships contradicting someone's presumed sexuality are likely perceived as violating expectations for them. It is exactly these discordant ties that may make for interesting gossip and rumors as they would violate node-specific heuristics. Moreover, when an individual's presumed sexuality is contradicted by a rumored tie, the discordance makes them behaviorally bisexual.[3] If (a) the implied norm is toward consistent sexuality and partner choice and (b) gossip and rumors often involve claims about normative violations, then (c) rumored relationship ties should frequently violate this expectation and be associated with a higher number of sexually discordant ties and behaviorally bisexual nodes. Thus, I expect that:

> *H3: Rumored ties should be more likely to involve partners whose gender is discordant with a target individual's non-rumored partners such that bisexuals are more numerous when rumored ties are present.*

If exclusively behaviorally straight people are more prevalent than those who are exclusively behaviorally gay or lesbian, then the typical network heuristic will be to form opposite-gender ties. Based on National Survey of Family Growth (NSFG) data, among 36,673 respondents who reported having at least one sexual partner and self-identified their sexual orientation, 85.2% were exclusively behaviorally straight and 1.3% were exclusively behaviorally gay or lesbian (13.6% behaviorally bisexual, NSFG 2011-2019; see Damico n.d.). Similarly, in General Social Survey (GSS) data, among 1,143 respondents who reported having at least one sexual partner and self-identified their sexual orientation, 89.5% were exclusively behaviorally straight and 1.1% were exclusively behaviorally gay or lesbian (9.4% behaviorally

[3] You can have any number of partners, including zero, and be bisexual in the sense of attraction or identity. However, only those with two or more partners can be bisexual in a behavioral sense.

bisexual, GSS 2012-2018; see Healy 2019). These demographics point to the expectation for much of gossip and rumor to involve claims about same-gender relationships about straight people as these allegations would be unexpected and therefore interesting. If (a) the implied norm within a primarily straight network is toward opposite-sex ties and (b) gossip and rumors often involve claims about normative violations, then (c) rumored relationship ties should frequently violate this expectation and be associated with a higher number of same-gender ties and lower heterosexuality overall. Thus, I hypothesize that:

> *H4: Rumored ties should increase the number of same-gender edges such that the average node is less straight when rumored ties are present.*

2.2 Analysis 3

2.2.1 Age homophily in heterosexual relationships

In addition to short cycles and discordant ties, there are likely tie formation heuristics concerning the ages of relationship partners.[4] Multiple studies have shown a general pattern within opposite-sex relationships wherein men prefer slightly younger female partners and women prefer slightly older male partners (Buss 1989; Conway et al 2015; Feighan 2018; Kenrick and Keefe 1992; Kenrick et al 1996). However, the size of the age difference between partners has shifted over time. In his musings on marriage more specifically, Theodoor H. Van de Velde (1930) pinpointed a 5-7 year age difference as ideal. In more recent years, the modal occurrence is for partners to be the same age or have no more than 3-4 years between them with

[4] Age is obviously not the only relevant partner characteristic with men often prioritizing physical attractiveness and women often prioritizing resource acquisition abilities and earnings prospects as well (Buss and Schmitt 1993; Buunk et al 2002; Dunn, Brinton, and Clark 2010:383; Eastwick and Finkel 2008; Edlund and Sagarin 2010:838; Li 2007; Li and Kenrick 2006; Regan et al 2000). Partner selection and the characteristics desired may also be influenced by each individual's level of sociosexuality or their openness to both long-term relationships and short-term casual sex relationships (Muggleton and Fincher 2017; Penke and Asendorpf 2008).

the man being older than the woman (England and McClintock 2009:806; Feighan 2018:3; Kenrick and Keefe 1992). Per Buss (1989), the mean preferred and mean actual age differences between married heterosexual partners in 27 countries were both roughly 3 years for men and women with men being the older partner (Buss 1989:9). In a larger study of 130 countries, Ausubel and colleagues (2022) found that the average age difference between married or cohabitating opposite-sex couples was for men to be 4.2 years older than their female partners. In the United States, the mean actual age difference between partners in first-time marriages declined between 1910 and 2010-2014 from 4.07 to 1.86 years (based on U.S. Census and American Community Survey data, Feighan 2018:93,112). Despite partners now being closer in age (Ciscato and Weber 2020:325-326), men are generally still the older party in opposite-sex marriages and cohabiting relationships (Feighan 2018).[5] Thus, the prevailing norm for tie formation between opposite-sex couples would be partners who are age matched or relatively close in age (i.e., within 1-4 years). I pose my first research proposition, which suspects that:

P1: The mean age difference for marriage ties should be no more than 4 years difference.

Moreover, I expect some degree of age homophily for marriage ties if this norm regarding age-matched partners holds. Thus, I hypothesize that:

H5: There should be some homophily on age for partners in marriage ties.

It is possible that the number of individuals entering age-discrepant marriages is low due to normative expectations for relationship partners' ages, especially expectations originating in

[5] Although older man-slightly younger woman is a pattern observed cross-culturally, whether this is a universally held preference has been contested (Antfolk et al 2015).

an individual's interpersonal network. Additionally, relationship duration, commitment, or investment may moderate age homophily norms such that long-term partner selection faces stronger constraints than that in short-term relationships (Etcheverry, Le, and Charania 2008). This may be partially due to greater interpersonal network monitoring of long-term relationships involving a high level of commitment or emotional and psychological investment (Bradford et al 2019; Johnson and Milardo 1984; Lewis 1973). If those in long-term relationships with more investment are more likely to face scrutiny of partners from close interpersonal contacts, then it follows that short-term relationships with less investment may be less subject to critique. Lessening the impact of perceived relationship marginalization (Lehmiller and Agnew 2007) and perceived interpersonal network disapproval (Felmlee 2001) may lead people to select more diverse partners in terms of age. This interaction between relationship duration, marginalization, and more diverse partner characteristics could occur in multiple ways. First, people seeking short-term relationships may deprioritize how much a potential partner's attributes align with interpersonal and normative expectations (especially given the importance of physical attractiveness in short-term partner selection; Buunk et al 2002; Kenrick et al 1993; Li 2007; Muggleton and Fincher 2017; Regan, Medina, and Joshi 2001; Schwarz, Klümper, and Hassebrauck 2020:185). This may especially be the case given that perceived and actual interpersonal network acceptance are strong predictors of commitment (Agnew, Loving, and Drigotas 2001; Blair and Holmberg 2008; Cox et al 1997; Etcheverry and Agnew 2004; Lehmiller and Agnew 2007; Sprecher and Felmlee 1992:889) and commitment determines relationship stability and duration (Drigotas and Rusbult 1992; Rhoades, Stanley, and Markman

2010).[6] Or, relationships may be less supported, more sanctioned, and more likely to result in dissolution when selected partners do not fit expectations (Lehmiller and Agnew 2007). Regardless of the pathway, more heterophilous ties as a structural artifact of more diverse or counter-normative partner selection in short-term relationships would be the same. If strong expectations of age similarity between marriage partners are somewhat relaxed for less established relationship types, then age differences may be more prevalent in romantic/dating and primarily short-term sexual ties.

While romantic/dating relationships may exhibit relative age similarity, partner selection may also include a broader range of ages if normative expectations are relaxed for these relationships. This is indeed the case with both men and women widening their acceptable age ranges beyond that of the usual 1-3 years difference between marital partners (Buunk et al 2001:244-245,248; Gobrogge et al 2007:720; Kenrick and Keefe 1992; Phua, Jimenez Sosa, and Aloisi 2018; Skopek, Schmitz, and Blossfeld 2011; see also Symons 1979 on preferences for a smaller age range for long-term relationships). Studies show the same gendered patterns as in marriages with men preferring to date women who are younger and women preferring men who are roughly their age or older (Conway et al 2015; Dunn, Brinton, and Clark 2010; Kenrick and Keefe 1992; Kenrick et al 1996). However, it has been shown that men seeking dating partners include increasingly younger women as their own age increases such that their specified age range is usually between 5-15 years younger (Kenrick and Keefe 1992; Kenrick et al 1995; Kreager et al 2014; Phua et al 2018; Skopek et al 2011).[7] Women also specify a wider age range,

[6] Approval and support from close friends and family is especially important and has been linked to greater relationship satisfaction and a lower likelihood of dissolution (Bryant and Conger 1999; Bryant, Conger, and Meehan 2001; Felmlee 2001; Sprecher and Felmlee 1992).

[7] The upper age limit specified by men is usually a female partner no more than 1-6 years older (Burrows 2013; Hitsch, Hortasçsu, and Ariely 2010; Kenrick and Keefe 1992; Kenrick et al 1995).

but the upper limit seems to hover around 9-10 years older than themselves (Kenrick and Keefe 1992; Hitsch, Hortasçsu, and Ariely 2010).[8] Thus, an acceptable maximum age difference (at least for the individual seeking a romantic partner) could include age gaps of 10-15 years (Banks and Arnold 2001:10). This establishes another normative expectation for romantic/dating relationships wherein partners are less likely to be age matched or close in age (i.e., within 1-4 years) compared to married partners. I pose a second research proposition for the celebrity network and suspect that:

> *P2: The mean age difference for romantic/dating ties should be no more than 8 years difference.*

Additionally, I posit that:

> *H6: Romantic/dating ties should be more strongly associated with large age differences than marriage ties.*

> *H7: (a) There should be some homophily on age for partners in romantic/dating ties, but (b) this will be less than that for marriage ties.*

If we continue the same logic of normative constraints weakening as relationship investment and commitment appear to weaken, then age differences should also be common in short-term liaisons of a primarily sexual nature. Here, the norm for short-term relationships would be partners being even less likely to be age matched or close in age (i.e., within 1-4 years)

[8] The lower age limit specified by women is usually a male partner no more than 2-5 years younger (Burrows 2013; Kenrick and Keefe 1992; Rajecki, Bledsoe, and Rasmussen 1991).

as in marital or romantic/dating relationships. I, therefore, pose a third research proposition and another two hypotheses wherein I suspect that:

P3: The mean age difference for short-term ties should be no more than 15 years difference.

H8: (a) Short-term ties should be more strongly associated with large age differences than romantic/dating ties and (b) short-term ties should be more strongly associated with large age differences than marriage ties.

H9: (a) There should be some homophily on age for partners in short-term ties, but (b) this will be less than that for romantic/dating ties and (c) this will be less than that for marriage ties.

There may also be a gendered effect regarding partner's age for primarily sexual short-term relationship ties. According to NSFG data, the majority of women aged 15-44 who had had sex within the 3 months prior to survey administration had partners within 2 years of their age (52.1%; Darroch, Landry, and Oslak 1999:163). The next most frequent age gap between sex partners involved a male partner 3-5 or 6 or more years older than their female partner (20.3 and 17.8%, respectively; Darroch et al 1999:163). In contrast, the least common pairing involved a male partner who was 3 or more years younger than their female partner (9.8%; Darroch et al 1999:163). Other studies report age differences of up to 25 or more years between sexually active adolescent girls and young women between ages 13-19 and their male partners (Elo, King, and Furstenberg 1999:77; Kaestle, Morisky, and Wiley 2002:306; Lindberg et al 1997:64). Based on these reports, it seems some men are willing to engage in primarily sexual short-term relationships with women 3-5 years younger or even adolescent girls a decade or more younger than themselves.[9]

Indeed, many men show a desire for young partners, especially in the context of sexual fantasies or interest even as their own age increases (Antfolk et al 2015:77; Buunk et al 2001:245; Gobrogge et al 2007:720; Silverthorne and Quinsey 2000). However, while men may "prefer women in their reproductive years for short-term relationships" (McKenzie 2021:505), women maintain a preference for similarly aged men (Antfolk et al 2015:77; McKenzie 2021:505) or have a higher minimum age requirement (Buunk et al 2001:245) even when they are open to partners younger than themselves. This means that the age range for short-term partners is a consistent target of ages 15-45 for men, but a shifting window relative to increasing age for women (Dunn et al 2010:389; Schwarz and Hassebrauck 2012:461-462). This mirrors the pattern for married and romantic/dating age preferences and points to a general norm wherein the accepted age range for men is larger than that for women. If this gendered effect (wherein men include a broader range of ages for potential partners than women) exists as a broader normative expectation, then I expect relatively larger age differences within older man-younger woman pairings. Thus, I hypothesize that:

> *H10: Ties where the male partner is older should be more strongly associated with large age differences than older female partner ties regardless of relationship type.*

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[9] Obviously, there is some measurement inequality given the direction of reproductive consequences which may make older man-adolescent girl pairings easier to track than older woman-adolescent boy pairings. This measurement issue could lead to under-reporting of older woman-adolescent boy pairings such that older man-adolescent girl pairings appear to be much more common.

2.2.2 Age gaps as counter-normative in heterosexual relationships

Whether the older man-younger woman pairing is explained by one or more theories on social exchange (e.g., economic, beauty-status exchange, etc.; McClintock 2014; Rosenfeld 2005), biological and evolutionary predispositions (e.g., fertility as a function of age, youth as an indicator of fertility, "paternity certainty," etc.; Buss and Schmitt 1993; Collisson and De Leon 2018:2108; Symons 1979), or gendered socialization (e.g., men's broader social mobility in heteropatriarchal societies, etc.; Levant and Rankin 2014; Stockard 1999) is not a concern here. What is important is that the frequency of older man-younger woman pairings establishes it as a norm which helps identify counter-normative age pairings. In particular, large age gaps and those involving an older woman and a younger man may be met with especially negative sentiment (Banks and Arnold 2001:15-16; Cowan 1984:20) and be viewed as counter-normative. Large age gaps and older woman-younger man relationships may therefore be especially likely to occur within exchanges of rumor and gossip.

A precise definition of a "large" age gap varies within the research. Some researchers define "large" age gaps as age differences between partners of four or more years (Drefahl 2010:323; Kaestle et al 2002:306), five or more years (Alarie 2019:468-469; Bozon 1991:120), roughly six or more years (Ausubel et al 2022; Darroch et al 1999:161), or ten or more years (Alarie and Carmichael 2015:1256; Lawton and Callister 2010:13; Lehmiller and Agnew 2011:7; Luke 2005:6; Niccolai and Swauger 2021; Pyke and Adams 2010:754; Shehan et al 1991:295-296; Vera, Berardo, and Berardo 1985:556). Other studies place the cutoff for large age gaps even higher at differences of 11 (Feighan 2018:62), 12.5 (Botzet et al 2023), or 15 or more years (Banks and Arnold 2001:9; Cowan 1984:17; England and McClintock 2009:806). However, the general consensus is that having a "substantial (i.e., greater than 10 year) age discrepancy does not appear to be the norm" (Lehmiller and Agnew 2011:9; see also Collisson and De Leon 2018:2108). Given my dissertation's focus on counter-normative tie formation when I refer to "age-gapped" (also called "age-discrepant" and "May-December") relationships, I will generally be referring to those involving age differences of 10 or more years (Lehmiller and Agnew 2007, 2008).

The norm of relationship partners being relatively close in age implies an underlying network heuristic against pronounced age gaps. If age-matched couples are more prevalent than age-gapped couples, then the typical network heuristic will be to form ties with partners who are relatively close in age to oneself. However, if gossip and rumor involve communicating and exchanging valuable information about normative violations, then these claims should inversely highlight expected tie formation patterns or structural heuristics. Thus, if (a) the implied norm within a primarily straight network is toward age-matched relationships and (b) gossip and rumor often involve claims about normative violations, then (c) rumored relationship ties should frequently violate this expectation and be associated with "large" age gaps. Therefore, I expect that:

H11: "Large" age gaps (i.e., age differences of 10 or more years) are especially likely to occur as rumored ties compared to relatively smaller age gaps.

H12: Ties are more likely to occur as rumored ties as age gap increases for opposite-sex ties.

2.2.3 Negative perceptions of age gaps in general and counter-normative age gaps in particular

In general, studies show that age-gapped relationships are frequently viewed as unacceptable (Banks and Arnold 2001:12), less satisfying (Banks and Arnold 2001:13), lasting only a short duration (Banks and Arnold 2001:12), or being less likely to succeed (Cowan 1984).[10] Involved partners may be perceived as having less in common (Banks and Arnold 2001:12) or having potentially dysfunctional relationship dynamics. For instance, onlookers may assume that partners are prioritizing resource acquisition/exchange (Collisson and De Leon 2018:2108) or seeking a "parental figure" or an overtly maternal or paternal dynamic (Banks and Arnold 2001:13). These results persist across gender and age groups such that the perception of age-gapped relationships is generally negative (Banks and Arnold 2001:16; Collisson and De Leon 2018:2112). Moreover, age-gapped relationships with especially large differences (e.g., 20 years or more; Banks and Arnold 2001:10) are even more likely to be viewed as unacceptable. While these negative perceptions may be somewhat moderated by the age and gender of the younger partner involved (Banks and Arnold 2001:15-16; Collisson and De Leon 2018:2110-2111) or the age (McKenzie 2015b; Sela et al 2018:7) and gender (Cowan 1984:22; McKenzie 2015b) of observers, the strength of disapproval generally increases as the age discrepancy increases (Banks and Arnold 2001:13,15).[11]

Age-gapped couples may be perceived negatively because they violate more recent relationship ideals regarding equitable attachment and symbolic/companionate love (Cherlin 2004; Van de Putte et al 2009). Rather than some explicit exchange of gendered resources (i.e., women trade youth, fertility, and beauty for men's ability to provide material support and financial stability; McClintock 2014; Rosenfeld 2005), relationships "ideally" should be based

[10] Some studies have found reports of higher life satisfaction (Groot and Van Den Brink 2002), more trust (Zak et al 2001), less jealousy (Zak et al 2001), and higher commitment (Lehmiller and Agnew 2008) among partners in age-discrepant couples. However, I prioritize third-party perceptions used to construct and maintain normative expectations over self-assessments.

[11] At least one study has found disapproval of older man-younger woman couples for the economic-erotic capital exchange discussed in Section 2.2.3.i ("Negative perceptions of much older men ("sugar daddies" and "cradle robbers")) is mediated by endorsements of prostitution by observers (Sela et al 2018).

on equality and compatibility between partners (McKenzie 2015a). A key concern for those opposing age gaps based on this logic may be some perceived inequity in what partners can theoretically contribute (Collisson and De Leon 2018:2111), the potential exploitation of the younger partner (Banks and Arnold 2001:10-11), or the predatory behavior of the older partner, especially older men (Collisson and De Leon 2018:2111).

2.2.3.i Negative perceptions of much older men ("sugar daddies" and "cradle robbers")

Oftentimes the most common image of an age-gapped couple involves a much older man and a younger woman (Lauzen and Dozier 2005; Shary 2014). Older man-younger woman couples may be met with disapproval (Banks and Arnold 2001:10; Collisson and De Leon 2018:2111; Cowan 1984:20), especially when the man is much older than their partner. Societal perceptions of these couples often invoke negative stereotypes of the older men as "sugar daddies" (Collisson and De Leon 2018:2109) or "cradle robbers" (Lehmiller and Agnew 2011:21) or of the younger women as "sugar babies" (Scull 2020:135-136) or "gold diggers" (Lehmiller and Agnew 2011:21). Older men are viewed as exploiting their status and financial stability to prey on the "erotic capital" (Hakim 2010) or youth, beauty, and sexual availability of their younger partner and vice versa for the younger women involved (Baumeister and Vohs 2004; Lehmiller and Agnew 2011:21). Thus, observers may object to this combination based on the assumption that partners are prioritizing economic-erotic capital exchanges over the pursuit of symbolic/companionate love between equals.

2.2.3.ii Negative perceptions of much older women ("sugar mommas" and "cougars")

Older woman-younger man couples are similarly met with social disapproval (Collisson and De Leon 2018:2111) and stereotypes about the interests of involved parties. Although less common compared to older man-younger woman, the inverse pairing is still associated with negative stereotypes of the older women as "sugar mamas/mommas" (Collisson and De Leon 2018:2109) or "cougars" (Alarie and Carmichael 2015:1250; Kaklamanidou 2012; Lehmiller and Agnew 2011:21; Vanderheiden 2021:369) or of the younger men as "boy toys/toy boys" or "cubs" (Vanderheiden 2021:369). Older women are viewed as desperate (Montemurro and Siefken 2014:41), sexually aggressive (Collard 2012; Lawton and Callister 2010:7), overly vain or concerned with projecting youth (Barrett and Levin 2014:580), and as exploiting the youth and virility of their younger partners (Alarie 2019:476; Montemurro and Siefken 2014:40; Voo 2007). Younger men involved with older women may be viewed as being preyed upon by older partners (Barrett and Levin 2014:581; Collard 2012). However, in comparison to younger women involved with older men, assumptions about trading "erotic capital" to meet financial interests may be less salient when thinking about younger men dating older women. It would seem observers primarily object to this combination based on the assumption that partners are pursuing more prurient interests rather than some idealized conceptualization of love.

2.2.3.iii Comparing negative gendered perceptions of younger partners

It is interesting to note how stereotypes of age-gapped relationships follow a sexual double standard (Milhausen and Herold 1999) even for the younger partners involved. These stereotypes reiterate gendered assessments of an individual's perceived sexual permissiveness such that women are judged more negatively than men (Lehmiller and Agnew 2011:21-22). For instance, while younger women are often called "gold diggers," there is no equivalent pejorative for younger men. "Sugar babies" emphasizes a transfer of financial benefits to the younger partner, but is a gender-neutral term. "Boy toy/toy boy" and "cub" seemingly emphasize a younger male partner's youth and potential lack of sexual experience, but this reflects more negatively on the older woman's sexually exploitative actions. Even a newer term and "boy toy/toy boy" synonym like "himbo" (Wareing 2012:67; Zane 2020) lacks a clear negative connotation for younger men. "Himbo" is not reserved for describing age-gapped relationships and simply references a conventionally attractive albeit vacuous man (Zane 2020). Additionally, "himbo," "boy toy/toy boy," and "cub" may highlight youth such that men above a certain threshold are less likely to be assigned these labels. "Gold digger," however, can be applied to women regardless of age. Men involved with older women might be referred to as "gigolos" (Warren 1996:76), but even here there is an implied equal exchange of monetary benefits for the man's sexual prowess. At worst, younger men attracted to older women might be seen as suffering from "Mommy issues" (Vera et al 1985) or an "Oedipus complex" (Sheleff 1976:1; Winch 1951:794-795), but these pathologizing terms are not specifically reserved for age-gapped relationships.

Moreover, compared to "gold digger" the terms "boy toy/toy boy" and "cub" lack the same connotation of the elder partner being detrimentally impacted by the younger partner's interest. Instead, an older woman pursued by a younger man may be described as a "MILF" or "Mom I'd like to fuck" which sexually objectifies her while maintaining his sexual agency and mobility. The equivalent term for men ("DILF" or "Dad I'd like to fuck") might involve some objectification, but it is not interpreted in the same way as MILF. This may be due to the double standard for aging wherein men's desirability is less tied to youth and appearance than women's (Deuisch, Zalenski, and Clark 1986; England and McClintock 2009). DILF might be perceived differently given men do not lose sexual appeal after having children in the way women do (Montemurro and Siefken 2012). Similarly, men are not constrained by mutually exclusive patriarchal constructions of sexuality which subset women into one of three major categories: pristine "virgins," maternal "Madonnas," and sexually available "whores" (Bareket et al 2018;

Friedman, Weinberg, and Pines 1998; Tanzer 1985; Tavris and Wade 1984). This aligns with stereotypes for older partners wherein the term "cougar" for women potentially has a more negative connotation than "cradle robber" for men (Lehmiller and Agnew 2011:21; Montemurro and Siefken 2014). In some instances, "cradle robber" may even be regarded positively as an indicator of a man's sexual prowess and mobility or desirability to potential partners (Lehmiller and Agnew 2011:21).

2.2.3.iv Comparing negative gendered perceptions of older partners

While age-gapped relationships generally elicit negative perceptions, relationships wherein an older woman pursues and dates a younger man may be especially disliked (Banks and Arnold 2001:13-14; Collisson and De Leon 2018:2110-2111; Cowan 1984:20). It has been suggested that pairings wherein the female partner is significantly older are viewed as less acceptable than vice versa (Alarie 2019; Banks and Arnold 2001). Granted, this gendered dynamic does not preclude significantly older male-younger female relationships (or even same-sex relationships) from being viewed as equally counter-normative due to age heterophily. But, perceptions of deviance and stigma (Goffman 1963:141) associated with older woman-younger man couplings is notable as these factors likely reinforce underlying norms for age-gapped relationships. Stronger negative perceptions of older woman-younger man relative to older man-younger woman may be due to these pairings going "against our innate mechanisms of mate selection" (Banks and Arnold 2001:8; Collisson and De Leon 2018:2108). These mechanisms dictate that "men seek fertility and reproductive value" (Banks and Arnold 2001:16) in female partners which women lose as they age. The seemingly inequitable trade-off of a younger man dating an older woman with lower fertility may exacerbate existing stereotypes of older partners contributing less to these relationships (Collisson and De Leon 2018:2109).

Additionally, older women's lower fertility is contrasted against younger men's higher virility relative to older men, such that the elder partner's interest would appear to be primarily sexual (Alarie 2019:476). Older man-younger woman couples may also be perceived this way if younger partners are regarded as having higher reproductive "mate-value" (Edlund and Sagarin 2010). However, negative perceptions may be offset by the extent to which the pairing reiterates heteronormative expectations (i.e., the older man eventually committing to and financially supporting the younger woman who is more likely to be able to produce children; Lehmiller and Agnew 2011:11,27). The same is not necessarily true for older woman-younger man which may lead to perceptions of little to no positive outcome for the younger partner (Banks and Arnold 2001:8).

Older woman-younger man pairings also challenge established interaction scripts reinforcing traditional gender roles (e.g., the norm of a slightly older man who is the primary financial provider; Eaton and Rose 2011; Lamont 2014) and sexual scripts (e.g., women as passive in heterosexual courtship; Alarie 2019:466-467; England, Shafer, and Fogarty 2008; Wiederman 2005). This may lead to perceptions of the older woman-younger man combination as an especially deviant (Alarie 2019:466) "role-reversed" relationship (Vink et al 2022a:130). A relationship is considered "role-reversed" if the male partner has a lower societal status or is perceived as less dominant than their female partner (Vink et al 2022a:131,132). Role-reversed relationships are associated with lower social acceptance and more relationship difficulties relative to role-conforming relationships (Vink et al 2022a:130-131; Vink et al 2022b). Most important for the chapter at hand is that for role-reversed relationships both male and female partners and overall relationship satisfaction are perceived negatively by onlookers (Vink et al 2022a:139,141,147). These negative perceptions may be observed in general avoidance of (or at least furtive participation in) such pairings which would further reiterate normative constraints against them.[12]

Taken together, we may observe a gendered network heuristic for age pairing wherein the relatively greater frequency of older man-younger woman compared to older woman-younger man relationships implies an underlying norm against the latter ties. If older man-younger woman couples are more prevalent than older woman-younger man couples, then the underlying network heuristic should reflect this gendered pattern. However, if valuable socially relevant information about normative violations is transmitted in gossip and rumor, then these claims may inversely highlight expected tie formation patterns or structural heuristics. Thus, if (a) the implied norm within a primarily straight network is toward men being the older partner and (b) gossip and rumor often involve claims about normative violations, then (c) rumored ties should frequently violate this expectation and be associated with ties wherein women are older than their male partners. Therefore, I expect that:

H13: Older woman-younger man ties are more likely to occur as rumored ties relative to older man-younger woman ties.

H14: Ties are more likely to be rumored for short-term ties where the female partner is older relative to when the male partner is older.

[12] The frequency of older woman-younger man marriages where the female partner is 11 or more years older has remained relatively the same since 1910 (Feighan 2018:93,95). Additionally, these pairings represent a small percentage of all marriages and continue to be outnumbered by similarly age-gapped older man-younger woman marriages (Feighan 2018:95,96).

2.2.4 Impact of celebrity on participation in age-gapped relationships

Celebrity networks may deviate from age matching trends observed in the general population for a number of reasons. In a May 2024 interview touching on why she was in a relationship with a man 39 years her junior, acclaimed 77-year-old singer Cher put it succinctly by stating "well, now they're all dead" about men in her age cohort (Wickman 2024). Even if Cher wanted to conform to the norm of women partnering with men within 4 years of their age, her options would be limited as American men's life expectancy was 74.8 years in 2022 – fully 5.4 fewer years than that of American women's life expectancy at 80.2 years (CDC 2024). Thus, there may be some survival bias wherein older men and women exit the dating market via marriage which leaves their unmarried age counterparts more likely to partner with someone younger. This may especially be the case given more favorable gender pay gaps (Fleck and Hanssen 2016; Smith and the Annenberg Inclusion Initiative 2020) and more equitable employment opportunities (Bazzini et al 1997; Lauzen and Dozier 2005) throughout men's careers in many entertainment industries. For celebrities in the film industry, women's careers are generally shorter (Fleck and Hanssen 2016) and a sustained presence may depend more on the interaction between youth, beauty, and initial success. Additionally, high-status men often use their elevated social position to pair up with partners much younger than themselves (Conroy-Beam and Buss 2019; Kenrick and Keefe 1992; Von Rueden, Gurven, and Kaplan 2011). These factors may lead to some exaggeration of status-beauty exchanges (Rosenfeld 2005) between older celebrities with more socioeconomic and career status and their younger counterparts. Ultimately, this heterophilous occupational mixing between age groups could result in more age gaps or larger age differences between partners. If the celebrity network somehow deviates from age gap norms, then ties in this network will not align with the general observations for age pairings. I pose a fourth and final research proposition and suspect that:

> *P4: If the celebrity network deviates from general age gap norms, then age differences for all relationship types will be higher than the cutoff values of 4, 8, and 15 years difference for marriage, romantic/dating, and short-term ties, respectively.*

Figure 2.1 A Network 4-cycle

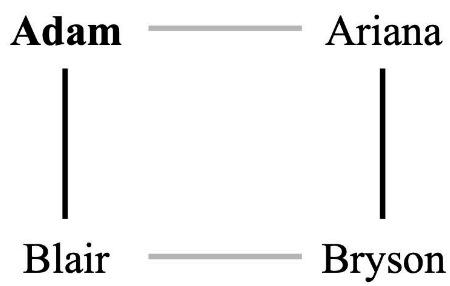


Figure 2.2 A Network 3-cycle

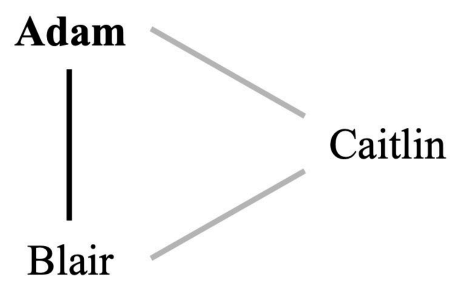


Figure 2.3 A Random Network with a Spanning Tree Structure and No Short Cycles

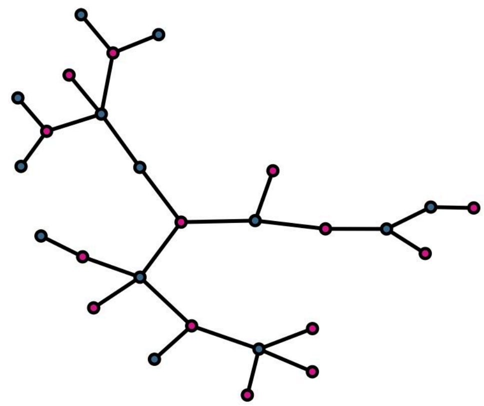
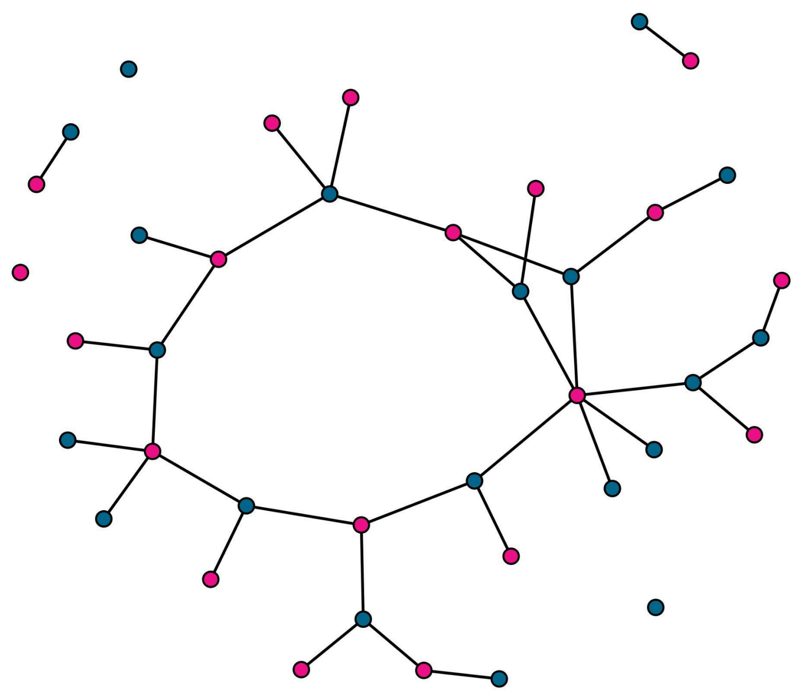


Figure 2.4 A Random Network with a "Chainlike" Spanning Tree Structure*



Note: * This network's structure is similar to that observed by Bearman, Moody, and Stovel (2004:59). The majority of nodes are connected in the large component (center) and there is one short cycle (4-cycle at right in the large component).

CHAPTER 3

Dataset

3.1 Dataset and Data Collection

Testing the potential relationship between gossip and rumor, norms, and network heuristics requires a dataset with a sufficiently large sample and an adequate number of identifiable rumored ties. Gossip and rumors about public figures such as celebrities, royalty, athletes, and other entertainers surface frequently and often involve allegations of affection. Thus, highly observable celebrity dating histories provide a unique opportunity to see whether and how rumored ties violate normative expectations and network heuristics.

I web-scraped my dataset from whosdatedwho.com (WDW) which is an online repository of romantic and sexual relationship ties primarily involving celebrities and notable figures in the entertainment, fashion, and sports industries whose lives hold some collective public interest (Currid-Halkett 2010:29). WDW allows site users to create and edit profiles for individual celebrities by adding content such as text information, external links, comments, and images. Each profile features a relationship history, relationship characteristics (e.g., type, start and end dates, whether ties are rumored, etc.), and demographic information about the featured individual (e.g., gender pronoun, age, occupation, etc.). Figure 3.1 shows an example of the information listed on a WDW profile entry (Who's Dated Who 2022).

-- FIGURE 3.1 ABOUT HERE --

3.2 Data Source and Data Concerns

Although WDW presents an interesting opportunity for exploration, there are many caveats and considerations to keep in mind when dealing with this crowd-sourced dataset. WDW initially launched in 2007 and currently garners over a million monthly visits (Similarweb 2023; see Appendix 1.1.1 for considerations regarding WDW's creation date). According to a website traffic report conducted in April 2023, the majority of site visits in March 2023 originated from Internet or VPN connections based in the United States (37.4%), the United Kingdom (8.2%), Canada (6.2%), India (4.2%), and Germany (3.4%; 40.5% "Other," Similarweb 2023). In terms of age, nearly half of all users on the site in March 2023 were estimated to be between 18-34 years old (20.6% 18-24, 27.0% 25-34, 17.8% 35-44, 14.6% 45-54, 11.5% 55-64, 8.6% 65 or older; Similarweb 2023). The site's user base may have a slight skew toward men with 52.7% male and 47.4% female users (Similarweb 2023). Demographically speaking WDW may be more relevant for or of greater interest to younger adult users in Western nations. This means any normative assessments or interpretations are most appropriately contextualized within the prevailing mores and attitudes of Western societies.

Listed dating profiles are populated using volunteer-verified submissions of confirmed and rumored relationships circulating in news, entertainment, or social media outlets. The site primarily focuses on notable public figures, but inclusion is not limited to those with celebrity status as lesser-known and non-famous partners are often listed. The site's focus on celebrities structures the dataset in ways that likely differ from more traditional sources. First, starting with celebrities means less famous people appear in the dataset only through ties to famous individuals. This means observed degree is a function of both actual degree and fame. For instance, British actor Hugh Grant has an observed degree of 13 while his less famous former partner Divine Brown has a degree of only four. Even though she likely has a much higher degree in reality due to her background in sex work (Daily News 1995), Brown is only included in the dataset because she has ties to Grant and other notable figures. Thus, because less famous people appear in the dataset only if they are linked to a celebrity (even if they have extensive partnership histories in their own right), this will result in a downward bias on degree and limit insights for people who are famous only by association. This issue, however, would be similar to that in other network studies where information about ties is gleaned via snowball sampling of a select population subgroup (Jackson 2008:54-55). Lastly, there may be some selection bias among less famous individuals included on WDW such that their relationship histories or partnering behavior has limited generalizability. This would especially be the case if openness to dating a celebrity is itself biased in terms of personality characteristics, sexual behavior, or number of partners. Thus, even when relatively less famous people are included, they may not be representative samples.

In terms of website structure, WDW has an open registration system and any individual with an Internet connection and a "legitimate" email address can create an account. Given the open registration system, the usefulness of scraped data depends on an editing schema that produces relatively accurate and reliable information. WDW uses a hierarchical editing schema, incentive systems (e.g., points for contributions, earned or awarded profile badges as public credentials), and oversight by approved moderators at the highest levels (see Appendix 1.1.2 for details on editing structure). This hierarchical setup appears to work fairly well to decrease obvious inaccuracies. A glance at Canadian pop singer Justin Bieber's profile indicates edits are screened for veracity, spam, and "trolling." Over several years, 99 suggestions were submitted to update Bieber's profile, but only seven were approved by moderators. Although there is no posted guidance regarding the assessment of submitted items or what merits acceptance or rejection, the selectiveness of approved suggestions for Bieber's page indicates some degree of screening occurs before updates are made. Thus, those ranked at higher editing levels (e.g., "Star

Editor" or above; see Appendix 1.1.2 for details on editing levels) are clearly cognizant of attempts to spam celebrity profiles and screen suggestions to exclude obviously or likely bogus information.

Where posted information is concerned, any site user can suggest adding, updating, or removing any conceivable relationship tie. Relationships can involve two individuals with existing profiles on the site or link an existing profile to a brand-new individual. Additionally, these ties are not limited to those between celebrities and can occur between famous and non-famous people (see Appendix 1.1.3 for notes on the nature of the celebrity dating market). Relationship suggestions may be current or past ties and can be submitted with additional information such as photographs of the couple, a location where the couple first met, the relationship type, external sources for the relationship's occurrence, and flags for further review or relationship deletion. After submission, relationship suggestions are then queued for registered users and "Star Editors" to comment on and for moderators to accept or reject. The site's open contribution system leads to variation in relationship history completeness and accuracy as these factors may be functions of the degree of relative interest in a particular celebrity. This dynamic could introduce some bias in that more extensive relationship histories are due to greater user interest in the featured individual rather than that individual being a relatively higher degree node. While moderators screening through suggested edits appears to reduce a great deal of noise, it is unclear whether they undertake additional work to build up less popular profiles. Thus, celebrities with greater "star power" and larger or more dedicated fan bases may be more likely to have higher completion and accuracy rates compared to less popular, less well-known, and non-famous individuals. This may lead to some accumulated advantage in profile completion and accuracy rates and may also increase the number of suggestions submitted for these profiles. However, even for celebrities with large active fan bases such as Justin Bieber a high percentage of suggestions are rejected by moderators which may temper some of the star power effect.

In addition to general relationship information, user suggestions can also indicate if a tie is “rumored,” but the site does not provide any guidance on what does or does not constitute a “rumor.” Confirmed relationships seem to be those that are explicitly acknowledged as true by one or both parties involved, but rumored relationships may include those lacking explicit confirmation, those originating from limited or unverifiable evidence, or those reported as rumored by external news sources. It is up to site moderators and “Star Editors” to determine which items are verifiable or at least reasonably credible based on common knowledge or cited sources and which items are fallacious, false, or otherwise unreliable. Some bias may arise due to a potential lack of consistency in what is considered credible or “rumored.” There may be some variation in what individual moderators consider “rumored,” but the primary consideration appears to be verifiability through additional sources or similar reports of the tie as “rumored” in media outlets.

One notable drawback of relying on external verification is that ties between celebrities and less well-known or non-famous people may be perceived as less likely to hold the public’s attention and thus may receive less media coverage. If this is the case, then these ties may be more likely to remain labeled as “rumored” or may be excluded from the site entirely. On the one hand, this could lead to over-selection of less famous people into “rumored” relationships with celebrities. On the other hand, it could lead to undersampling “rumored” ties between celebrities and less famous partners, which may have distinct characteristics relative to “rumored” celebrity-celebrity relationships. It’s also possible that the external sources for rumored ties have a vested interest in circulating these claims in media outlets. Celebrity public relations teams may attempt to generate buzz by creating rumored relationships or not explicitly addressing speculation that arises organically. If public relations teams do actively create rumored ties, they may aim to increase buzz by linking their clients to popular celebrities which would add to the star power effect for targeted individuals. Additionally, many rumored budding romances between celebrities end as confirmed relationships, which means these ties would begin as rumored and change to confirmed or would only enter the network as confirmed ties.[13] However, these ties likely make up a small proportion of all rumored ties and the specific origin of rumors does not negate the general pattern wherein these claims may capture attention due to alleged counter-normative actions. There is also no clear indication that media and public relations teams can track how specific rumors violate network heuristics such as short cycles. Thus, there is no indication that rumored relationships are constructed and pushed by public relations teams to violate specific network heuristics of interest to my dissertation. Similarly, it would be somewhat difficult for WDW moderators to cognitively track the presence of normative or network heuristic violations without actively cross-referencing multiple relationship histories. Thus, there is no indication that ties are initially or retroactively evaluated by WDW moderators for violating normative expectations or network heuristics and then marked as "rumored."

3.3 Network Sample

The initial scrape of WDW was conducted between July 2019-October 2020 and captured 111,441 listed profiles. I combined these profiles into an initial set of network ties and screened them to remove duplicate ego and alter node entries (425 unique nodes with 644 unique ties) and nodes with un-codable or missing data on gender (4 unique nodes with 27 unique ties; see

[13] This means included rumored ties represent a singular (rather than longitudinal) snapshot of the network.

Appendix 2.1.1 for details on these cases). The latter cases had either anonymized names or pseudonyms listed with no additional characteristics to code their gender or identity. Additionally, I also removed profiles for nodes with "Pornstar" as their listed occupation (1,389 unique nodes with 5,361 unique ties). Network structures of interest may be artificially increased in the adult film industry for two reasons. First, there is a bounded population of performers which increases the likelihood of short cycles. Second, consumer demand for specific content such as depictions of female homosexuality and group sex increases the prevalence of behavioral bisexuality (see Appendix 3.1 for notes on the exclusion of those employed in the adult film industry). Table 3.1 summarizes key demographic statistics for the resulting network sample (see Appendix 4.1 for additional demographic statistics).

-- TABLE 3.1 ABOUT HERE --

3.3.1 Gender and age

WDW does not have a designated profile field for gender. Instead, I coded gender based on other information such as pronouns occurring in free-form text, the associated gender of names by birth year, and the presence of gendered data (e.g., "bust size"). I combined this information to code gender using the multi-step approach described in Appendix 2.1.2-2.1.7 which only allows for dichotomous gender (see Appendix 2.1.3 for information on coding of "they/them" pronouns). The large sample size makes network measures fairly robust to errors in the coding of gender pronouns. In terms of the gender distribution, network nodes are fairly evenly split between men and women (49.4 and 50.6% men and women, respectively). The average node in the dataset was middle-aged as of October 2020 (mean birth year of 1964, median birth year of 1967; among 76,700 nodes with verifiable information on age as of October 2020).

3.4 Network Characteristics

The screened edge list was simplified using the {igraph} package version 1.2.5-1.2.6 (Csárdi and Nepusz 2006) in R version 4.0.2 to remove redundant network edges.[14] This produced a network sample containing 109,626 nodes and 88,746 edges. Table 3.2 summarizes descriptive statistics for the network. Overall, the network is very sparse with 477 and 12,529 cycles of lengths 3 and 4, respectively. To assess the extent to which the network is composed of multiple smaller disjoint or disconnected networks,[15] I checked the size of the giant and second-largest components. The giant component has 34,093 nodes (approximately 30% of all nodes) which is greater than the $n^{2/3}$ value indicative of a giant component (here, $n^{2/3}$=2,290.6; Jackson 2008:98). In contrast, the second-largest component contains 115 nodes (approximately 0.1% of all nodes) which is less than the $n^{2/3}/2$ value indicative of a small component (here, $n^{2/3}/2$=1,145.3; Jackson 2008:98). If the giant and second-largest components are roughly equal in size, it would indicate the network is actually two mostly separate sub-networks. On the other hand, if the giant component contains a much larger proportion of nodes than the next largest component, then the dataset is likely more similar to a single network.

-- TABLE 3.2 ABOUT HERE --

The giant component is also smaller than what would be expected in a random (Erdős-Rényi) graph with the same number of nodes and edges (about 70% in the giant component). This may indicate some underlying constraints in the network. For instance, isolated dyads are common and there is also a temporal structure (e.g., it is impossible for

[14] Later instances of simplifying the screened network edge list use {igraph} package version 1.4.2 or earlier backwards compatible versions (Csárdi and Nepusz 2006) in R version 4.0.5 or earlier.

[15] Thanks to several anonymous journal reviewers for noting this concern, especially with regard to potentially disjoint networks due to a lack of concurrency in celebrity life spans.

Charlie Chaplin, who died in 1977, to have dated Beyoncé, who was born in 1981). While a network where some ties or paths simply cannot exist might present a problem for some analytical techniques (e.g., ERGM), this presents less of an issue for my analyses for two reasons. First, Random Tie Deletion Resampling (RTDR) is a non-parametric approach and there are no assumptions built into the model that require any potential dyad to be possible. Second, I focus on highly local metrics (i.e., 3-cycles, 4-cycles, node bisexuality, mean edge sexuality) for structures limited to a node's egocentric network (e.g., bisexuality) or the local neighborhood within a short path length from a node (e.g., 3-cycles).

Based on the sizes of the giant and second-largest components, it does not appear that the network is two distinct sub-networks with no overlap between respective node sets. I thus treat the dataset as a single network rather than multiple smaller networks. The dataset is effectively a flattened longitudinal network that I treat as cross-sectional due to missing observations on date of tie formation (n=21,976 edges or 24.7% of edges missing tie start date) and the time-bound nature of tie formation (e.g., it is impossible to date someone who died before you were born).

3.4.1 Rumored ties

"Rumored" ties in this network refer to alleged relationships not explicitly confirmed or otherwise self-nominated by the involved partners. In the context of an online repository, posting relationship ties is a mediated form of gossip and rumor and similarly involves transmitting information about an absent third party. Approximately 4.3% (n=3,848 edges; see Table 3.2) of all network edges are listed as "rumored."

3.4.2 Node degree (k_i)

The overall degree (k_i) distribution is over-dispersed and right-skewed with values ranging between 0 and 103 and the average node having 1.62 network ties (median degree of

1.00; see Figure 3.2). At first glance, the degree distribution's shape appears to resemble a power law distribution. If it does follow a power law, this may indicate some preferential attachment processes at work. I conducted hypothesis testing for model fit using the {poweRlaw} R package (version 0.70.6; Gillespie 2015) following Broido and Clauset's (2019) argument regarding the rarity of true power law distributions and scale-free networks. The null hypothesis for these tests presumes that the data are generated from and are best fit by a power law distribution (Gillespie 2024:5). The alternative hypothesis is that the data are not produced by a power law and are comparatively better fit by an alternative distribution (Gillespie 2024:5). The fit of the degree distribution to a power law is compared to log-normal, exponential, and Poisson distributions via bootstrapping to calculate *p*-values for evaluating the null and alternative hypotheses (Gillespie 2024:5). Larger *p*-values indicate that a power law should be favored over an alternative distribution, but *p*-values closer to 0 indicate that a power law is a less appropriate fit relative to the alternative distribution (Gillespie 2024:5). The resulting *p*-values for these tests show the degree distribution is best fit by either a Poisson or an exponential model (p=0, 0.15, 0.32, and 0.46 for power law, log-normal, exponential, and Poisson model, respectively). While most individuals have between 1-2 partners and there is a small minority of people with a notably larger share of partners, it does not appear that the network is scale-free based on the *p*-values for these tests.

-- FIGURE 3.2 ABOUT HERE --

3.4.3 Rumored ties and degree by gender

Table 3.3 summarizes descriptive statistics for the network broken down by node gender. Rumored ties are more or less evenly split between men and women (4.0 and 4.2% of men and women with rumored ties, respectively). Both groups have similar average degree values (mean degree of 1.64 and 1.59 for men and women, respectively; median degree of 1.00 for both men and women). Gini coefficient values measuring inequality indicate a moderate level of inequality on degree (k_i) with approximately equal values for men and women (0.34 overall and 0.35 and 0.36 for men and women, respectively; see Table 3.2 and Table 3.3).

-- TABLE 3.3 ABOUT HERE --

Figure 3.1 Example whosdatedwho.com (WDW) Profile Entry

WHO'S DATED WHO LOGO BANNER

Primary Profile Photo of Focal Celebrity

Name and Occupation

Rank	Age	Zodiac	Relationships
#	**#**	*zodiac symbol*	**#**
	years old	*zodiac sign*	total

Focal Celebrity's dating history

Who is [he/she] dating right now?

Focal Celebrity is currently single.

Relationships

Summary of past relationships with information on start and end dates, relationship type, and rumored relationships.

Dating History

#4	#3	#2	#1
Partner #4 Photo	*Partner #3 Photo*	*Partner #2 Photo*	*Partner #1 Photo*
Partner #4 Name	Partner #3 Name	Partner #2 Name	Partner #1 Name
Likes and Dislikes Count	Likes and Dislikes Count	Likes and Dislikes Count	Likes and Dislikes Count
Start Year-End Year	Start Year-End Year	Start Year-End Year	Start Year-End Year
Relationship Description	Relationship Description	Relationship Description	Relationship Description

Table 3.1 Demographic Statistics for WDW Network (109,626 Nodes and 88,746 Edges) [a]

Demographic Characteristic:	Count *n*:	Percent %:	Valid Percent %:
Age: [b]			
≤ 25	2,056	1.9	2.7
26-45	25,922	23.7	33.8
46-65	23,574	21.5	30.7
66-85	18,910	17.3	24.6
≥ 86	6,301	5.8	8.2
NA	32,863	30.0	-
Gender:			
Men	54,157	49.4	49.4
Women	55,469	50.6	50.6
Listed Sexuality:			
Bisexual	1,134	1.0	2.3
Disputed	211	0.2	0.4
Gay	917	0.8	1.8
Lesbian	469	0.4	0.9
Straight	47,507	43.3	94.6
NA	59,388	54.2	-
Total Obs:	**109,626**	**100.0**	**-**

Note: a Percent totals may not sum to 100.0% due to rounding error.

b Age as of 10/2020.

Table 3.2 Descriptive Network Statistics for WDW Network (109,626 Nodes and 88,746 Edges) With and Without 3,848 Rumored Ties

Network Statistic:	**With 3,848 Rumored Ties:**	**Without 3,848 Rumored Ties:**
Network Order and Size:		
Nodes	109,626	108,129
Edges	88,746	84,898
n Nodes in Largest Component	34,093	30,975
% of Nodes in Largest Component	31.1%	28.6%
Short Cycles:		
3-cycles	477	331
4-cycles	12,529	9,498
Bisexual Nodes: [a]		
n	1,945	1,740
% of Nodes	1.8%	1.6%
Rumored Ties:		
n	3,848	0
% of Nodes	4.3%	0.0%
Node Degree:		
Mean	1.62	1.57
Median	1.00	1.00
Maximum	103	93
Ego Network Homophily:		
Gini Coef. for Node Degree	0.34	0.32
Mean Sexuality Score	0.906	0.908

Note: a Bisexual nodes have an egocentric sexuality score with an absolute value not equal to 1.

Figure 3.2 Degree Distribution for WDW Network (109,626 Nodes and 88,746 Edges) on a log-log Scale

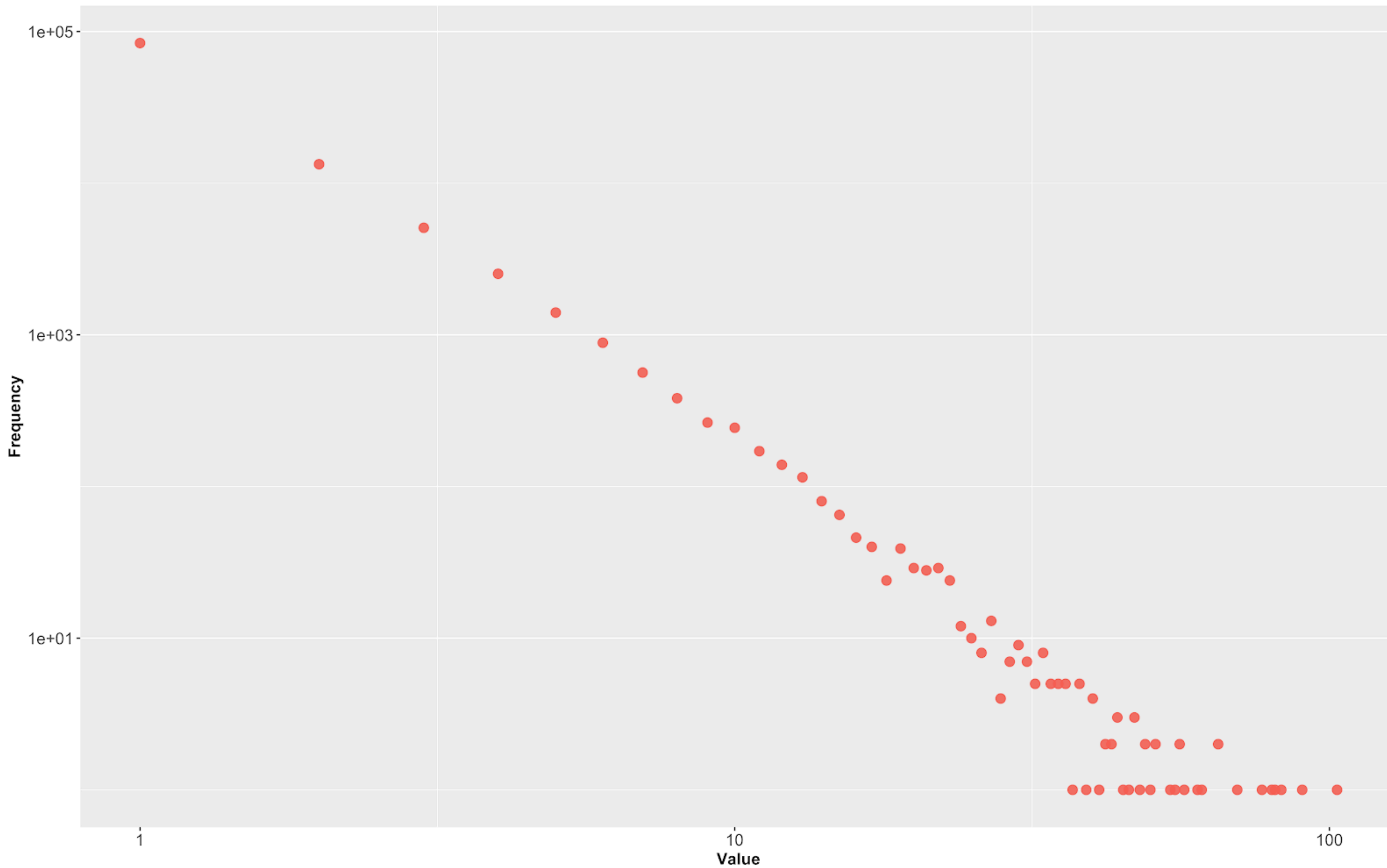


Table 3.3 Descriptive Network Statistics by Node Gender for WDW Network (109,626 Nodes and 88,746 Edges)

	Gender		
Network Statistic:	***Men*:**	***Women*:**	***Total*:**
Bisexual Nodes: [a]			
n	909	1,036	1,945
%	1.7%	1.9%	1.8%
Nodes with Rumored Ties:			
n	2,187	2,337	4,524
%	4.0%	4.2%	4.1%
Total Nodes:			
n	54,157	55,469	109,626
Node Degree:			
Mean	1.64	1.59	1.62
Median	1.00	1.00	1.00
Maximum	103	90	103
Ego Network Homophily:			
Gini Coef. for Node Degree	0.35	0.36	0.34
Mean Sexuality Score	0.893	0.917	0.906

Note: a Bisexual nodes have an egocentric sexuality score with an absolute value not equal to 1.

CHAPTER 4

Methods

4.1 Analysis 1

My key empirical question is whether there is anything structurally special about rumored ties as an identifiable subset of edges. Methods for estimating structural effects at the edge-level generally fall into one of several categories: exponential random graph modeling (ERGM), $p*$ models, link-tracing, and random network rewiring or other simulations of random networks. Where edge deletion methods are concerned, several studies use one or multiple iterations of edge removals to estimate the structural impact of including targeted ties (adams et al 2012; adams, Moody, and Morris 2013). Another common approach is creating a baseline of counterfactual cases to compare against an observed network (adams et al 2012) or targeted deletion models (adams et al 2013). Creating a baseline of counterfactual networks often involves constructing a distribution of values from multiple iterations of a random deletion process (i.e., bootstrapping a distribution; adams et al 2012; adams et al 2013; Bearman et al 2004; Papachristos and Smith 2012). Finally, some studies calculate *z*- or *t*-scores to quantify relative effect sizes for network measures of interest (adams et al 2012; Papachristos and Smith 2012).

In their analysis of the benefits of including secondarily recruited respondents via "link-tracing" sampling, adams et al (2012:176) used a node-first approach to identify edges for removal. The authors first identified "cross-link" nodes (i.e., individuals identified by at least two directly recruited respondents) and then removed the non-redundant and unique edges associated with these nodes (adams et al 2012:186). In each of the 100 iterations, the authors randomly selected an equal number of direct recruits as there were "cross-link" nodes and then randomly deleted network ties associated with directly recruited respondents (adams et al 2012:186). These random deletion models were used to construct null distributions and then compared against the observed network and counterfactual networks targeting nodes of a specific type based on standardized *z*-scores (adams et al 2012:186-187).

While there is some overlap between the approaches used by adams et al (2012), adams et al (2013), Papachristos and Smith (2012), and my method, there are also some differences. First, adams et al (2012:186) constructed a distribution comparing deviation from the observed network for one tie type among different subsets of nodes. In comparison, I focus on one tie type for all nodes in the network. Moreover, I use an edge-first approach to remove ties with no regard for node type. My edge-first reduction method differs from adams et al (2012:186) who initially targeted specific nodes ("cross-links") and then ties associated with those nodes. adams et al's (2012) node-first approach also involved removing a secondary set of ties stemming from targeted "cross-link" nodes. I only target ties of interest and do not remove any secondary sets of ties or information uniquely associated with nodes. Second, I incorporate a comparison between a simulated network with all targeted ties removed and one wherein an equal number of ties as there are targeted ties are randomly deleted. In comparison, adams et al (2013:324) constructed a baseline of networks using random edge deletion, but due to their network's size were only able to delete 2-14% of either all network ties or targeted ties of interest. Lastly, I extend the use of a bootstrapped distribution constructed from random deletion networks by calculating *z*-scores to indicate ordinal structural effects when rumored ties are included in the network. Although adams et al (2013:324,325,326) is similar in their use of bootstrapped distributions of random edge deletion networks, they did not calculate *z*-scores comparing these models to those wherein ties were more specifically targeted for removal. In contrast to adams et al (2013), but similar to adams et al (2012), Papachristos and Smith (2012) calculated one-sided *t*-scores to assess variation from observed network properties in two distributions of simulated networks (1,000 simulated networks each; Papachristos and Smith 2012:30). However, these distributions were constructed from conditional random graphs based on a Bernoulli distribution and ERGM (Papachristos and Smith 2012:30,31) rather than random tie deletion.

It's also important to note that other network studies often use similar or overlapping terminology such as "*random* permutation," "edge deletion," "simulation," or "bootstrapping," but this does not mean similar methods as RTDR were used. For instance, Onnela et al (2007) analyzed mobile cell phone call interactions to assess the role of weak and strong ties within the network. They first *randomly* permuted edge weights representing tie strength and counted the number of inter- and intra-community links (i.e., "bridges" and "local roads," Onnela et al 2007:7334). In contrast to my method, they did not remove any edges (whether targeted or at random) for this edge weight analysis. Onnela et al (2007) also conducted *edge deletion* based on tie strength and degree of overlap between node neighborhoods to assess the call network's structural resilience (Onnela et al 2007:7334). However, removal of edges was not random. Instead, a fraction of edges were deleted based on either increasing or decreasing values for tie strength and degree of overlap such that strongest to weakest ties were removed and vice versa (Onnela et al 2007:7334). The authors also *bootstrapped* distributions by conducting two diffusion model simulations of 1,000 iterations each. In the experimental model, the probability of a piece of information spreading further was based on the duration of a call between two nodes (Onnela et al 2007:7334). In the control model, the probability of spread was set to the mean value of tie strength in the network (Onnela et al 2007:7334). Their distributions compared the fraction of infected nodes and the fraction of infected users as a function of time (Onnela et al

2007:7334). They also plotted a distribution for the probability of information spread as a function of the tie strengths for network links responsible for initially "infecting" nodes (Onnela et al 2007:7334). While Onnela et al's (2007) simulations involved bootstrapping, they focused on adjusting the value of tie strength and did not delete ties (whether targeted or at random).

Thus, my approach combines multiple aspects of previous methods (targeted and random edge deletion, multiple iterations of network simulations, bootstrapping a null distribution, and *z*-scores for comparison) to assess whether and how key network parameters change when rumored ties are present. An additional benefit of RTDR is that it is much more computationally efficient than ERGM, especially for a large network of over 100,000 nodes. I first calculate the number of 3-cycles, the number of 4-cycles, the number of bisexual ego nodes, and the average node's sexuality in the observed network. Next, I remove all rumored ties from the network and re-calculate these four parameters. Then, in 1,000 iterations, I delete a random set of ties equal to the number of rumored ties in the network and calculate each of the four parameters to build a null distribution of standard error (*SE*) values. Finally, I calculate *z*-scores comparing the observed network less all rumored ties to the null distribution values for my key measures of interest. These *z*-score values are calculated as follows:

-- EQUATION 4.1 ABOUT HERE --

Where the network metrics are represented as the Metric of Interest (MOI) and σ represents the standard deviation of the random tie deletion distribution such that z equals the MOI value in the targeted deletion network minus the average MOI value in the random deletion networks divided by the standard deviation of the random deletion network distribution.

Given that my hypotheses are directional, I use one-tailed tests such that *z*-score critical values of ±1.65 and ±2.33 are significant at the .05- and .01-level, respectively. *Z*-scores are inversely interpreted such that negative *z*-scores indicate more of the associated parameter when some rumored ties are present, but less of that parameter when all rumored ties are removed. Likewise, positive *z*-scores indicate less of the associated parameter when some rumored ties are present, but more of that parameter when all rumored ties are removed.

4.1.1 Variables and Measures

4.1.1.i Short cycles

To test my first two hypotheses regarding network short cycles and "over-closeness," I identify cycles of length 3 and 4 by first removing nodes with degree values less than or equal to 1. I remove nodes with degree values less than or equal to 1 as these nodes represent isolate nodes or isolated dyads wherein an individual is either unconnected or connected to only one other person in the network. Such isolate nodes and isolated dyads cannot be involved in short cycles of length 3 or 4 as these structures require a minimum of two network ties. After removing isolates and isolated dyads, I then conduct a network *k*-cycle census using the *kcycle.census*() function from the {sna} package (version 2.6) in R version 4.0.2 (Krivitsky et al 2003-2023).

4.1.1.ii Sexuality

To test my third and fourth hypotheses on discordant ties, I calculate an egocentric measure of preference for partner gender to indicate sexuality. This involves calculating the External-Internal (EI) egocentric homophily score for each node, which is a frequently used measure of homophily or segregation (Bojanowski and Corten 2014:19-20). In the analysis at hand, I use EI scores to indicate the proportion of ties to partners of the same gender out of all ties and calculate this value as follows:

-- EQUATION 4.2 ABOUT HERE --

External and internal groupings are determined based on the gender of the ego node of interest. Partners of the opposite gender are considered "external" group members whereas partners of the same gender are considered "internal" group members. The value of EI is calculated by subtracting the number of "internal" group members (i.e., partners of the same gender) from the number of "external" group members (i.e., partners of the opposite gender) and dividing by the focal node's total number of partners. The minimum and maximum values for the EI egocentric homophily score are -1.00 and 1.00, respectively (Bojanowski and Corten 2014:19). I use these EI scores to indicate sexuality as a function of partner gender selection. Thus, nodes with ties to only same-gender partners ("gay/lesbian") have an EI score of -1.00. Nodes with ties to only opposite-gender partners ("straight") have an EI score of 1.00. Nodes with some mixture of same- and opposite-gender partners ("bisexual") have an EI score less than 1.00, but greater than -1.00. For a network-level measure of sexuality, I first calculate node sexuality scores and then take the average of these scores across nodes.

4.2 Analysis 2

RTDR results from Analysis 1 could point to broader associations between rumored ties and network structures, but a closer descriptive analysis is needed to specify exactly what is occurring within short cycles. I conduct a cycle motif analysis and define "motifs" as "small, local subgraphs" (Felmlee, McMillan, and Whitaker 2021:2) representing one of many possible recurring combinations of node attributes or edge types (Milo et al 2002).[16] I focus this portion of

[16] A "motif" is technically defined as the "densities" of "small groups of vertices" (Newman 2010:264), but is frequently operationalized as counts of the various combinations of different node or edge types (see examples cited in Felmlee, McMillan, and Whitaker 2021).

my analysis on node gender, edge sexuality, inferred node sexuality, and the number of rumored ties within cycles (e.g., how many 3-cycles involve three gay men?, how many 4-cycles involve two rumored ties?, etc.).

Following the same protocol described in the "Variables and Measures" section for counting short cycles in Analysis 1 (Section 4.1.1.i), I assess short cycle motifs in the WDW network. After removing isolate nodes and isolated dyads (i.e., nodes connected to either zero nodes or one other node), I identify 3- and 4-cycles using a network *k*-cycle census using the *kcycle.census*() function from the {sna} package (version 2.7; Krivitsky et al 2003-2023) in R version 4.0.2. Finally, I use the cycle census to re-construct and list individual network cycles and then match included nodes and edges to attributes of interest. Expanding the cycle census from a straightforward count to include qualitative attributes allows me to assess the frequency of different edge and node attribute configurations.

4.3 Analysis 3

For my third analysis, I subset the dataset and focus on opposite-sex edges wherein both ego and alter node have sufficient information on date of birth (i.e., at least year of birth) to maintain a consistent sample. I further limit my analysis to opposite-gender edges and exclude same-sex ties. Same-sex ties make up a smaller percentage of all ties in the network. Additionally, smaller pools of potential partners within LGBTQIA+ communities may affect normative expectations for participation in, perceptions of, and constraints on age-gapped relationships. According to Conway and colleagues (2015), both gay men and lesbian women seeking partners via dating advertisements preferred "increasingly younger mates with increasing age" (2015:666; see also Silverthorne and Quinsey 2000) and accepted a wider range of partner ages than heterosexual individuals (2015:666). Same-sex male couples in Western nations may be more likely to have large age gaps compared to opposite-sex or same-sex female couples (Schwartz and Graf 2009; Verbakel and Kalmijn 2014). The greater likelihood of age gaps among gay and bisexual men relative to lesbian and bisexual women mirrors the gendered heterosexual dynamic wherein straight men prefer younger partners (Gobrogge et al 2007; Kenrick et al 1995). But, these relationships may not be regarded negatively and can take on a mentorship dynamic maintaining cultural knowledge and interactional scripts (Silva 2023). Age gaps in same-sex male pairings do not necessarily align with negative gendered dichotomies of "sugar daddies" and "gold-diggers" or "cougars" and "boy toys/toy boys" (Silva 2023). While I exclude same-sex ties from Analysis 3, these relationships should be examined in their own right while keeping pertinent LGBTQIA+ contexts in mind.

The first portion of Analysis 3 is conducted using statistical tests and network estimations in R version 4.1.2. I start by assessing age gap values based on the three relationship types as well as the gender of the older partner. As shown in Figure 4.1, absolute values of age gaps for edges included in Analysis 3's network subsample follow an over-dispersed and right-skewed distribution. Given my outcome variable of interest does not adhere to assumptions regarding normality for *t*-tests of means (Mendenhall, Beaver, and Beaver 2009:405), I instead use negative binomial regression to find statistically significant predictors of the log count of age gaps.[17] I use the *glm.nb*() function from the {MASS} package (version 7.3-54; Ripley et al 2024) to assess whether large age gaps are predicted by the three relationship types. I also use the *vglm*() function from the {VGAM} package (version 1.1-8; Yee and Moler 2024) to assess whether large age gaps are predicted by gender of the older partner, specifically older male

[17] Although the distribution for absolute value of age gaps shown in Figure 4.1 includes numerous 0 values, I opt for a negative binomial regression (as opposed to a zero-inflated variant) as these are true rather than "excess" 0 values (UCLA Advanced Research Computing 2024a).

partners. I opt for a zero-truncated negative binomial regression for the test of gendered effects given that the categorical variable excludes observations with age differences equal to 0 (UCLA Advanced Research Computing 2024b). My respective null hypotheses for this portion of my analysis are that the three relationship types and gender of the older partner are not statistically significant predictors of increases in the number of age gaps. My alternative hypotheses posit that short-term relationships and an older male partner will be statistically significant predictors of the number of age gaps relative to marriage and older woman-younger man ties, respectively. I interpret model coefficients significant at the .05-level as indicating sufficient statistical evidence that having more age gaps is more reliably predicted by romantic/dating, short-term, and older man-younger woman ties than their opposing categorical types.

-- FIGURE 4.1 ABOUT HERE --

In addition to comparing age gaps by relationship type, I also calculate assortativity coefficients using the *assortativity*() function in the {igraph} package (version 1.4.2; Csárdi and Nepusz 2006; Csárdi 2003-2024) to assess age homophily overall and for each relationship type. Assortativity coefficients take labels or values assigned to nodes as attributes and measure the degree of homophily (i.e., the extent to which similar nodes are connected; Newman 2010:222) in a graph. For scalar attributes (e.g., age, etc.), normalized assortativity is calculated as:

-- EQUATION 4.3 ABOUT HERE --

Here, A_{ij} represents all ties between nodes with the same scalar value in the network, $k_i k_j$ represents the degree of scalar ties, m is the number of edges in the network, $x_i x_j$ represents observed scalar ties, k_i is degree, and δ_{ij} is the Kronecker delta (Newman 2010:223,228-229).

Assortativity coefficients are a Pearson's correlation coefficient for some specified node property that may be shared between pairs of adjacent nodes (Newman 2010:229). Thus, network assortativity coefficients for a specified node attribute tell us how correlated attribute values are between pairs of nodes in the network. Stated differently, assortativity values indicate the likelihood of connected pairs sharing the attribute value of interest. Assortativity coefficients can be between -1.00 and 1.00 with negative and positive values indicating adjacent nodes are dissimilar or similar, respectively, based on the attribute of interest. Higher assortativity coefficients approaching 1.00 indicate a stronger tendency toward homophily on the specified attribute. In contrast, lower assortativity coefficients approaching -1.00 indicate a stronger tendency toward heterophily (i.e., the extent to which dissimilar nodes are connected) on the specified attribute. An assortativity coefficient equal to 0 would indicate neither strong homophily nor strong heterophily.

Next, I use chi-squared tests and logistic regression to examine the likelihood of ties being rumored depending on increasing age gap value, age gaps greater than or equal to 10 years, and involvement of older female partners. I first use chi-squared tests to examine potential associations of ties being rumored with age gaps of 10 or more years and older female partners using the *chisq.test*() function. I then use the *glm*() function to run a logit model assessing whether increasing age gap values or gender of older partner are statistically significant predictors of ties being rumored. My respective null hypotheses are that none of the aforementioned factors are associated with or statistically significant predictors of network ties being rumored. In contrast, my alternative hypotheses predict that rumored ties will be reliably associated with and predicted by increasing age gap values, age gaps greater than or equal to 10 years, or older woman-younger man ties relative to smaller age gap values, age gaps less than 10 years, and older man-younger woman ties, respectively. Test statistics and regression coefficients reaching significance at the .05-level indicate sufficient statistical evidence that whether a tie is rumored is associated with or reliably predicted by increasing age gap value, large age gaps, and older female partners.

4.3.1 Variables and Measures

4.3.1.i Relationship type

Ties on WDW can be described using a variety of labels to indicate the type of relationship (e.g., "Encounter," "Married," "NA," "On-screen," "Relationship," "Unknown"). For my analysis, I consider network edges labeled "Married," "Relationship," and "Encounter" as representing marriage, dating/romantic, and short-term relationship ties, respectively.[18] The latter category appears to encompass multiple short-term relationship types, but seems to primarily indicate ties of a sexual nature (e.g., "hook ups," one night stands, or other relationships lacking exclusivity or a monogamous context). I exclude relationships labeled "NA," "On-screen," and "Unknown" which may lack sufficient information for categorization on WDW or may not represent organically formed relationships.

4.3.1.ii Age gaps

I examine the impact of age gaps by calculating the absolute value of age differences between opposite-sex partners at the time of tie formation. If the date of tie formation was not available, I assume both partners' ages were equal to the median value for either gender within this subset (54 and 61 years old for women and men, respectively). I then top-code age gap values at 65 years age difference as age gaps above this value likely represent input errors on

[18] I use the relationship type label as there is more coverage on this variable than exact tie duration (n=28,286 ties with information on exact duration versus n=37,019 ties with relationship labels).

WDW or do not represent a plausible relationship occurrence. I code a categorical version of this variable to focus on age gaps greater than or equal to 10 years given potential variation in a tie's counter-normativity as the size of the age difference increases (Lehmiller and Agnew 2011).

4.4 Summary of Methods and Hypotheses

I have covered a lot of ground in the preceding sections of my dissertation, so it's helpful to review a concise list of my proposed methods and hypotheses before discussing my findings. Table 4.1 lists my 14 hypotheses along with the substantive topics of interest and proposed analytic methods. My first four hypotheses concern the structural impact of rumored ties in the WDW network and will be tested using the RTDR method. In each of these cases, I expect that rumored ties will have a significant structural effect on the related network metrics (i.e., number of short cycles, number of bisexuals, and network sexuality).

-- TABLE 4.1 ABOUT HERE --

I posed four research propositions regarding mean age differences in the network based on relationship type as well as how these values vary from what would be expected by the literature. Hypotheses 5, 7, and 9 focus on the extent to which there is age homophily between partners in different relationship types and I use network homophily analysis for these portions. Hypotheses 6, 8, and 10 focus on the observed mean values for age gaps based on relationship type to determine if large age gaps are significantly associated with short-term relationships and older man ties. Hypotheses 6 and 8 discuss comparative differences in the association between age gap values and relationship type and will be tested using negative binomial regression models. I expect that relative to marriage relationships, large age gap values will be more strongly associated with and more numerous for romantic/dating and short-term relationship types. Hypothesis 10 introduces gendered effects on mean age gap values and is assessed using a zero-truncated negative binomial regression. I posit that older man ties should be more strongly associated with large age gaps relative to older woman ties regardless of relationship type. Finally, Hypotheses 11, 12, 13, and 14 are tested using chi-squared tests of association and logistic regression models to examine how the likelihood of a tie being rumored is impacted by age gap size, whether age gaps involve a difference of 10 or more years, and the involvement of older female partners. Here, I expect rumored ties will be associated with and reliably predicted by increasing age gap values, differences of 10 or more years, and ties involving an older woman-younger man pairing.

$$z = \frac{(MOI_{Targeted\ Tie\ Deletion} - Mean(MOI_{Random\ Tie\ Deletion\ Distribution}))}{\sigma_{Random\ Tie\ Deletion\ Distribution}}\ .$$

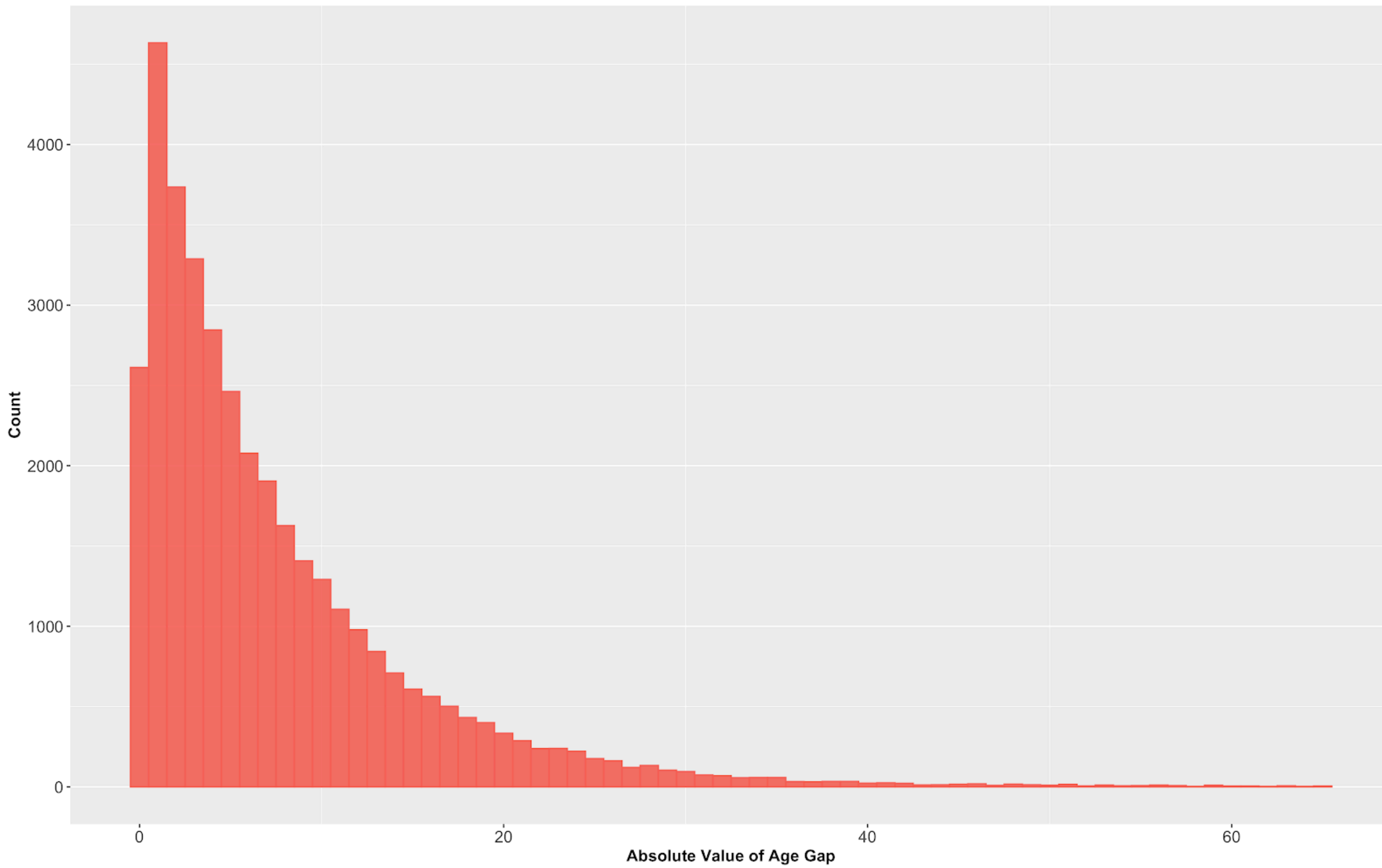
Equation 4.1 Random Tie Deletion Resampling (RTDR) *z*-score Formula

$$EI_i = \frac{(External\ -\ Internal)}{(External\ +\ Internal)}\ ,\ s.t.$$

$$EI_i = \frac{(Opposite\text{–}Gender\ Partners\ -\ Same\text{–}Gender\ Partners)}{(Opposite\text{–}Gender\ Partners\ +\ Same\text{–}Gender\ Partners)}\ .$$

Equation 4.2 External-Internal (EI) Egocentric Homophily Score Formula

Figure 4.1 Distribution of Age Gap Values in Age Gap Subsample (45,134 Nodes and 37,019 Edges) from WDW Network



$$r = \frac{\sum_{ij}(A_{ij} - k_i k_j / 2m) x_i x_j}{\sum_{ij}(k_i \delta_{ij} - k_i k_j / 2m) x_i x_j}.$$

Equation 4.3 Normalized Assortativity Coefficient for Scalar Attributes Formula

Table 4.1 Summary of Substantive Topics, Analytic Methods, Research Hypotheses and Proposition Statements [a]

Analysis:	Substantive Topic:	Analytic Method:	#:	Research Hypothesis or Proposition *Statement:*	*Page*:
1	**Short cycles and "over-closeness"**	*RTDR*	H1	Rumored ties should be more likely to occur in short cycles of length 4 such that 4-cycles are more numerous when rumored ties are present.	14
			H2	Rumored ties should be more likely to occur in short cycles of length 3 such that 3-cycles are more numerous when rumored ties are present.	15
	Discordant ties and sexuality		H3	Rumored ties should be more likely to involve partners whose gender is discordant with a target individual's non-rumored partners such that bisexuals are more numerous when rumored ties are present.	16
			H4	Rumored ties should increase the number of same-gender edges such that the average node is less straight when rumored ties are present.	17
3	**Marriage age gaps**	*Mean values*	P1	The mean age difference for marriage ties should be no more than 4 years difference.	18
		Age homophily	H5	There should be some homophily on age for partners in marriage ties.	18
	Romantic/dating age gaps	*Mean values*	P2	The mean age difference for romantic/dating ties should be no more than 8 years difference.	21
		Negative binomial regression	H6	Romantic/dating ties should be more strongly associated with large age differences than marriage ties.	21
		Age homophily	H7	(a) There should be some homophily on age for partners in romantic/dating ties, but (b) this will be less than that for marriage ties.	21
	Short-term age gaps	*Mean values*	P3	The mean age difference for short-term ties should be no more than 15 years difference.	21
		Negative binomial regression	H8	(a) Short-term ties should be more strongly associated with large age differences than romantic/dating ties and (b) short-term ties should be more strongly associated with large age differences than marriage ties.	21
		Age homophily	H9	(a) There should be some homophily on age for partners in short-term ties, but (b) this will be less than that for romantic/dating ties and (c) this will be less than that for marriage ties.	22
	Effect of gender on relative age gaps	*Zero-truncated negative binomial regression*	H10	Ties where the male partner is older should be more strongly associated with large age differences than older female partner ties regardless of relationship type.	23
	Effect of rumors on relative age gaps	*Chi-squared test of association*	H11	"Large" age gaps (i.e., age differences of 10 or more years) are especially more likely to occur as rumored ties compared to relatively smaller age gaps.	25
			H12	Ties are more likely to occur as rumored ties as age gap increases for opposite-sex ties.	25
	Effect of rumors and gender on relative age gaps	*Logistic regression*	H13	Older woman-younger man ties are more likely to occur as rumored ties relative to older man-younger woman ties.	32
			H14	Ties are more likely to be rumored for short-term ties where the female partner is older relative to when the male partner is older.	32
	Effect of celebrity on relative age gaps	*Mean values*	P4	If the celebrity network deviates from general age gap norms, then age differences for all relationship types will be higher than the cutoff values of 4, 8, and 15 years difference for marriage, romantic/dating, and short-term ties, respectively.	33

Note: a Age homophily assessed using assortativity coefficients.

CHAPTER 5

Findings

5.1 Analysis 1 – "Spilling the Tea: Rumored Ties, Short Cycles, and Node Sexuality"

Based on descriptive statistics, the WDW celebrity relationship network is far from acyclicity; it contains 477 3-cycles and 12,529 4-cycles. Most dyads are between nodes of opposite genders with only 1.8% of nodes having both same- and opposite-gender ties and only 4.1% of nodes having exclusively same-gender ties (*n*=1,945 and 4,438 nodes, respectively; see Table 5.1). There are roughly equal proportions of behaviorally bisexual men and women in the network (1.7 and 1.9% of men and women, respectively; see Table 5.1). The percentages of behaviorally bisexual men and women in the WDW dataset are lower than those observed in other U.S. samples. For instance, in the NSFG samples, there were 5.8 and 19.9% behaviorally bisexual men and women among respondents who had at least one sexual partner and self-identified their sexual orientation (*n*=36,673 respondents, 2011-2019; see Damico n.d.). In the GSS samples, there were 8.2 and 10.4% behaviorally bisexual men and women among respondents who had at least one sexual partner and self-identified their sexual orientation (*n*=1,143 respondents, 2012-2018; see Healy 2019).

-- TABLE 5.1 ABOUT HERE --

The resulting mean value of EI sexuality scores in the WDW network is 0.91. Thus, the average person has more opposite- than same-gender ties which is in line with other surveys from U.S. samples. In the NSFG and GSS data, of those who had at least one sexual partner and who also self-identified their sexual orientation, the average individual had an EI score of 0.90 and 0.91 (*n*=33,673 and 1,143 respondents, respectively). Similarly, surveys of American and global samples since 2012 have found between 80-96.6% of adult respondents identified as straight or heterosexual (Herbenick et al 2010 (weighted percentage); IPSOS 2021; Jones 2021; Ward et al 2014).[19]

5.1.1 RTDR Results

Table 5.2 summarizes results from 1,000 iterations of the RTDR method applied to the WDW celebrity network. These results show that specifically removing all rumored ties is associated with fewer 3- and 4-cycles, fewer nodes with bisexual partnering activity, and a higher mean network sexuality score indicating more straight relationship ties. These associations all have rather large *z*-scores and are statistically significant at the $p<.001$ level. We can visually see these effect sizes in Figure 5.1 wherein the point estimates for these metrics when all rumored ties are removed fall a considerable distance away from the distribution of values for random tie deletion networks. Thus, when randomly deleting an equivalent number of ties as there are rumored ties networks on average had more short cycles, more bisexual nodes, and higher network sexuality scores. This indicates statistically significant support for my first four hypotheses which posit that rumored ties should be associated with more network cyclicity, more bisexual nodes, and lower overall network sexuality.

-- TABLE 5.2 ABOUT HERE --

-- FIGURE 5.1a-d ABOUT HERE --

[19] Obviously, not all respondents were in relationships at the time of survey administration. In the Herbenick et al (2010) sample, only 70.3% of respondents were in some sort of romantic or dating partnership at the time of or within a year prior to survey administration. Hence, these estimates of sexual orientation include individuals whose self-identified orientation cannot be verified by survey responses.

5.2 Analysis 2 – "Four's a Party and Three's a Crowd: Exploring Motifs for Short Cycles by Node Gender, Edge Sexuality, and Rumored Ties"

5.2.1 Motifs of Node Gender and Edge Sexuality

I have not proposed concrete hypotheses for Analysis 2 as my primary concern is investigating different configurations of node attributes and edge types. The short cycle motif analysis reveals the following patterns for 3- and 4-cycles in the WDW network. Figures 5.2 and 5.3 show the frequencies of network short cycle motifs by node gender and edge sexuality for 3- and 4-cycles, respectively. The most frequent gender combinations for network 3-cycles involve two women and one man or three men (*n*=205 and 110 3-cycles with two women and one man or three men, respectively). In terms of the sexuality of edges (i.e., same- versus opposite-sex ties), the most common 3-cycle edge motif involves two opposite-sex ties and one same-sex tie (between two women and one man) or three same-sex ties (between three men; *n*=205 and 110 3-cycles with two opposite-sex ties and one same-sex tie or three same-sex ties, respectively). It is less common for 3-cycles to involve two men and one woman or three women (*n*=86 and 76 3-cycles with two men and one woman or three women, respectively). Again, thinking about these combinations as representing edge sexuality reveals that the least frequently observed motif involves two opposite-sex ties and one same-sex tie between two men and one woman or three same-sex ties between three women. Thus, most 3-cycles contain two-thirds heterosexual and one-third lesbian ties or only gay ties while fewer 3-cycles contain two-thirds gay and one-third heterosexual ties or only lesbian ties.

-- FIGURE 5.2 ABOUT HERE --

-- FIGURE 5.3 ABOUT HERE --

The network cycle census for 4-cycles returned a different total relative to that in Analysis 1's RTDR models (*n*=13,069 4-cycles in Analysis 2 versus *n*=12,529 4-cycles in Analysis 1). It is unclear why this issue occurred, so I tentatively regard cycle motif values for 4-cycles as indicating general patterns for these structures. Network 4-cycles involving two women and two men are overwhelmingly the most common gender combination with 12,152 such short cycles. When we consider this combination as an edge sexuality motif, 4-cycles involving only opposite-sex ties are the most common in the WDW network (*n*=12,126 4-cycles with only opposite-sex ties). This finding is unsurprising given the network involves primarily heterosexual relationships. However, a subset of the 4-cycles evenly split by gender involve two same-sex ties in addition to two opposite-sex ties (*n*=26 4-cycles with two opposite-sex ties and two same-sex ties). Stated differently, while most 4-cycles are completely heterosexual in nature, there are a handful of 4-cycles with a mix of straight, gay, and lesbian relationships.

The next most common 4-cycle gender motifs involve four men or three women and one man (*n*=374 and 354 4-cycles with four men or three women and one man, respectively). When represented as motifs of edge sexuality, 4-cycles involving four same-sex ties between four men or two opposite-sex ties and two same-sex ties between three women and one man are roughly equal in number. The least common 4-cycle gender motifs involve four women or one woman and three men (*n*=170 and 129 4-cycles with four women or one woman and three men, respectively). Thus, the least common edge sexuality motifs for 4-cycles are those involving four same-sex ties between four women or two opposite-sex ties and two same-sex ties between one woman and three men. Comparatively, 4-cycles that are either completely gay in nature or one-half heterosexual and one-half lesbian are more common than those that are either completely lesbian in nature or one-half heterosexual and one-half gay.

We can infer node sexuality based on the node gender motifs shown in Figures 5.2 and 5.3. The two most common 3-cycle motifs involve either two bisexual women and one straight man or three gay men. Similarly, the two most common 4-cycle motifs involve either two straight men and two straight women or four gay men.

5.2.2 Motifs of Rumored Ties

Turning now to rumored tie motifs, Figures 5.4 and 5.5 show the frequencies of network short cycle motifs by number of involved rumored ties. Rumored ties appear in 30.6 and 23.7% of network 3- and 4-cycles, respectively (*n*=146 3-cycles and 3,130 4-cycles). For 3-cycles, the most common motifs involve three non-rumored ties followed by two non-rumored ties and one rumored tie (*n*=331 and 115 3-cycles with three non-rumored ties or two non-rumored ties and one rumored tie, respectively). The least common rumored tie motif is a 3-cycle composed entirely of these ties (*n*=4 3-cycles with three rumored ties). Similarly, for 4-cycles the most common motifs are four non-rumored ties followed by three non-rumored ties and one rumored tie (*n*=10,049 and 2,119 4-cycles with four non-rumored ties or three non-rumored ties and one rumored tie, respectively). As with 3-cycles, the least common rumored tie motif for 4-cycles is one composed entirely of these ties (*n*=26 4-cycles with four rumored ties).

-- FIGURE 5.4 ABOUT HERE --

-- FIGURE 5.5 ABOUT HERE --

5.3 Analysis 3 – "Very Mature for Your Age: Age Gaps, Relationship Type, Gendered Norms, and Rumored Ties"

Tables 5.3 and 5.4 show demographic and descriptive network statistics for the subsample of opposite-sex edges wherein both ego and alter node have sufficient information on date of birth (i.e., at least year of birth). This network subsample includes 41.2% (n=45,134) of the initial 109,626 network nodes, 41.7% (n=37,019) of the initial 88,746 network edges, and 28.7% of the initial 12,529 network 4-cycles (n=3,589). As noted in Chapter 3 (Section 3.2, "Data Source and Data Concerns"), a potential caveat of assessing a subset of ties with sufficient date of birth information is that included individuals may be more well-documented if they are more notable or distinct in other ways. This subset of observations is similar to the full sample in terms of the gender distribution of nodes (49.3 and 50.7% men and women in the age gap subsample versus 49.4 and 50.6% men and women in the full network sample) and mean degree (k_i) of included nodes (1.64 in the age gap subsample versus 1.62 in the full network sample; medians equal to 1.00 for both). However, the percentage of rumored ties among edges with sufficient date of birth information is slightly higher than the percentage of rumored ties in the full sample (5.4 versus 4.3%, respectively). Given that key descriptive statistics for the opposite-sex, age-gapped subsample do not substantially vary from that in the full sample, I assume this subset is similar to the overall network of ties.

-- TABLE 5.3 ABOUT HERE --

-- TABLE 5.4 ABOUT HERE --

Table 5.5 shows the proportion of edges with an observed age gap value in the age gap subsample. As previously noted, I top-code age gap values at differences of more than 65 years which results in 152 edges being collapsed as the uppermost value (*n*=36,867 edges with age differences of 65 or fewer years, 152 edges with age differences of 66 or more years). Age-gapped ties of 5 or more years difference make up 53.8% of all ties within this subset (*n*=19,906 age-gapped ties of 5 or more years difference). Age-gapped ties of 10 or more years difference make up 28.2% of all ties (*n*=10,429 age-gapped ties of 10 or more years difference). Among the nearly one-third of ties with an age difference greater than or equal to 10 years, the proportion of ties decreases as age gap values increase (13.3, 6.8, 3.6, 1.9, and 1.0% of subsample ties with age gaps equal to 10-14, 15-19, 20-24, 25-29, or 30-34 years difference, respectively).

-- TABLE 5.5 ABOUT HERE --

Frequencies, means, and median values for the two key types of age-gapped ties are listed in Table 5.6. Overall, the mean absolute value for age gaps at the time of tie formation for all relationship types is 7.95 years (median equal to 5 years).[20] In terms of the frequencies of different relationship types, "Married" and "Relationship" ties are the most common with "Encounter" being the third most common (*n*=16,948, 15,495, and 4,227 ties, respectively). The overall mean absolute value of 7.95 years difference is approximately the same when considering only "Married" and "Relationship" ties, but is relatively larger for "Encounter" ties (means equal to 8.00, 7.63, and 9.04 years difference for "Married," "Relationship," and "Encounter" ties; medians equal to 5, 5, and 6 years difference, respectively). In response to my informal research propositions, it initially seems that the average values for age gaps in the WDW network somewhat vary from what would be predicted by the literature. "Married" ties have a larger

[20] The mean absolute value of age gaps of roughly 8 years difference may indicate some amplification of selection effects in gendered exchanges of partner characteristics (e.g., women exchanging youth and beauty for men's wealth and ability to procure resources; Rosenfeld 2005).

mean age gap than my expected cutoff of 4 years, but “Relationship” and “Encounter” ties both have smaller mean age gaps than my expected 8 and 15-year cutoffs.

-- TABLE 5.6 ABOUT HERE --

When split by gender and when age gaps are defined as any difference of 5 or more years between partners, there are over 4.5 times as many older man-younger woman pairings than older woman-younger man pairings (*n*=16,337 and 3,569 older man-younger woman and older woman-younger man pairings, respectively). Not surprisingly, the mean absolute age difference for ties where men are at least 5 years older than their female partners is larger than that for older woman-younger man ties (means equal to 13.36 and 11.96 years, medians equal to 10 and 8 years, respectively).

The overall mean age gap value may be inflated by oversampling high-degree nodes with multiple age-gapped ties (i.e., individuals who repeatedly form age-discrepant ties and who also have many partners). I check for this possibility by distinguishing between “first” and “most recent” ties. “First” ties represent either the sole tie for nodes with only one relationship or the earliest tie for nodes with two or more relationships in the network.[21] “Most recent” ties represent either the sole tie for nodes with only one relationship or the most recent instance of tie formation for nodes with two or more relationships in the network. Table 5.7 lists the mean and median age gap values for all relationship tie types as well as first only and most recent only relationship ties. The mean age gap value for most recent relationship ties only (*n*=6,110) is higher than that for first relationship ties only (*n*=9,044; means equal to 8.12 and 7.30 years, respectively; medians equal to 5 years difference for both).

[21] It should be noted that while the simplified network dataset used for Analysis 1 and 2 did not include isolate nodes or isolated dyads (i.e., individuals with either no ties or only one tie in the network), Analysis 3 retains isolated dyads and only excludes isolate nodes.

It's also possible that including both first marriages and remarriages increases the mean age gap value for "Married" ties due to the increased likelihood of large age gaps associated with remarriage (Feighan 2018:19,108; Shehan et al 1991). I test for this possibility by comparing the mean age gap values for first marriage ties only (*n*=14,089) and most recent marriage ties (i.e., remarriages; *n*=2,859) among nodes with multiple "Married" ties. As shown in Table 5.7, first marriage ties have a mean age gap value of 7.71 years difference and most recent marriage ties have a mean age gap value of 9.41 years difference (medians equal to 5 and 6 years difference, respectively).

A similar pattern is observed for "Relationship" and "Encounter" ties. Most recent "Relationship" ties have a larger mean age gap value than first "Relationship" ties (means equal to 8.12 and 7.30 years difference, respectively; medians equal to 5 years difference for both). Most recent "Encounter" ties likewise have a larger mean age gap value relative to first instances of this tie type (means equal to 9.11 and 8.99 years difference, respectively; medians equal to 6 years difference for both).

Reconsidering my four research propositions when accounting for the impact of oversampling high-degree nodes and first versus most recent ties, I find the average values for age gaps in the WDW network continue to vary somewhat from what would be predicted by the literature. First and subsequent "Married" ties have larger mean age gap values than my expected cutoff of 4 years with remarriage ties involving age differences of over 9 years. Remarriages, however, align with expectations from the literature and involve larger age gaps than initial marriages. The mean age gap value for most recent "Relationship" ties only is slightly above my expected cutoff of 8 years. But, the first instance of "Relationship" ties and both first and most recent “Encounter” ties remain below the 8 and 15-year cutoffs stated in my research propositions.

-- TABLE 5.7 ABOUT HERE --

Table 5.8 shows frequencies, means, and medians for age-gapped ties when defining age gaps as any difference of 5 or more years between partners and when accounting for gender of older partners and relationship type. Mean absolute age differences for ties where men are at least 5 years older than their female partners are larger than that for older woman-younger man ties for each of the three relationship types. Average age gap values are all greater than 10 years difference for both older male and older female partners regardless of relationship type, but these values follow two trends. For age gaps involving older women, mean values appear to increase alongside relationship commitment level such that “Married” ties have a larger age difference than “Encounter” and “Relationship” ties (means equal to 13.18, 11.65, and 11.00 years; medians equal to 8, 9, and 8 years difference, respectively). For older man ties, mean values follow the pattern observed in the overall sample with “Married” and “Relationship” ties having similar values, but “Encounter” ties having a larger value (means equal to 13.26, 13.24, and 14.20 years; medians equal to 10, 10, and 11 years difference, respectively). Thus, older man ties generally have larger age differences than older woman ties, but only older man ties follow the logic of short-term relationships involving larger age gaps relative to long-term partnerships. Interestingly, mean age gaps for ties with similarly aged partners are the only values that follow the expectation that the size of age differences will increase as relationship commitment level decreases.

-- TABLE 5.8 ABOUT HERE --

As shown in Table 5.9, there is a consistent pattern wherein most recent ties involve the largest mean age gaps for both older male and older female partners as well as for partners categorized as age-matched. The exceptions to this are mean age gap values for: (a) older woman ties for first ties only when no distinction is made between relationship types, (b) older woman ties for first "Married" ties only, and (c) first "Encounter" ties only regardless of gender of older partner or age matching. Overall, age gaps appear to increase as individuals form more ties (particularly remarriage ties) in the network.

-- TABLE 5.9 ABOUT HERE --

5.3.1 Negative Binomial Logit Results

Table 5.10 shows the results from two negative binomial logistic regression models used to test Hypotheses 6 and 8 (Model 1 and Model 2).[22] Model 1 uses a categorical coding of relationship type with "Married" as the reference group to predict the log count of the absolute value of age gaps. "Relationship" has a coefficient of -0.03 which is statistically significant at the p=0.001 level. This means that the expected log count of the absolute value of age gap decreases by 0.03 when moving from a "Married" to "Relationship" tie. Thus, there are fewer age gaps when moving from "Married" to "Relationship." This finding refutes Hypothesis 6 which posited that romantic/dating ties will be more strongly associated with large age differences relative to marriage ties. The coefficient for "Encounter" in Model 1 is equal to 0.15 and is statistically significant at the p=0.000 level. This means that the expected log count of the absolute value of age gap increases by 0.15 when moving from a "Married" to "Encounter" tie. Thus, there are

[22] As previously noted, more recent ties have larger age gaps for most relationship types and older man ties are more likely to have large age gaps regardless of type. Although I do not distinguish between "first" and "most recent" ties in logit models, these effects would be somewhat (though not completely) captured by the inclusion of interaction terms between age gap values and relationship type and gender of older partner and relationship type.

more age gaps when moving from “Married” to “Encounter.” The model coefficient for “Encounter” provides support for Hypothesis 8b which expected short-term ties would be more strongly associated with large age differences than married ties.

Results from Model 2 used to test Hypothesis 8a are also shown in Table 5.10. Model 2 also predicts the log count of the absolute value of age gaps, but uses a categorical coding of relationship type such that “Relationship” is the reference group against “Encounter.” “Encounter” has a coefficient of 0.18 which is statistically significant at the p=0.000 level. This means that the expected log count of the absolute value of age gap increases by 0.18 when moving from a “Relationship” to “Encounter” tie. Thus, there are more age gaps when moving from “Relationship” to “Encounter.” Model 2’s results support Hypothesis 8a which expected short-term ties would be more strongly associated with large age gaps than romantic/dating ties.

-- TABLE 5.10 ABOUT HERE --

5.3.2 Zero-truncated Negative Binomial Logit Results

Given the results of the negative binomial logit models described above, I include relationship type in the zero-truncated negative binomial logit models predicting the expected log count of age gaps based on the gender of the older partner. Table 5.11 shows the results from the zero-truncated negative binomial logistic regression model used to test Hypothesis 10 (Model 3). Model 3 uses the categorical coding of relationship type used in Model 1 such that “Married” is the reference group. As shown in Table 5.11, including categorical indicators of an older male partner and relationship type removes the significance of moving from a “Married” to “Relationship” tie as a predictor of the log count of age gap values. However, moving from a “Married” to “Encounter” tie and the involvement of an older male partner are statistically significant. “Encounter” has a coefficient of 0.07 which is statistically significant at the p=0.000

level. This means that the expected log count for the absolute value of age gap increases by 0.07 when moving from a "Married" to "Encounter" tie even while holding constant the effect of ties with older male partners. Thus, there are more age gaps when moving from "Married" to "Encounter" even when accounting for gender of older partners. Similarly, older male partner has a coefficient of 0.13 which is significant at the p=0.000 level. This coefficient indicates that the expected log count for the absolute value of age gap increases by 0.13 when moving from an older woman tie to an older man tie holding constant the effect of relationship type. Thus, there are more age gaps when moving from older woman-younger man ties to older man-younger woman ties even when accounting for relationship type. This finding supports Hypothesis 10 which predicted that regardless of relationship type older male partner ties will be more strongly associated with large age differences relative to older female partner ties.

-- TABLE 5.11 ABOUT HERE --

5.3.3 Age Homophily Results

I test Hypotheses 5, 7, and 9 by calculating age assortativity coefficients for the three key relationship types. As shown in Table 5.12, the coefficient for all relationship types is approximately 0.73, which indicates a strong tendency for connected nodes within this subsample to be of similar ages. As noted in my initial findings on mean age gap value by relationship type, including initial and later relationship ties might increase the mean age gap value and thus decrease age homophily. This may particularly affect values for marriages given remarriages are associated with large age differences (Feighan 2018:19,108; Shehan et al 1991) and given subsequent "Married" ties have a larger mean age gap value compared to first "Married" ties. Similarly, high-degree nodes with multiple age-gapped ties may skew assortativity values as these nodes would be effectively oversampled relative to nodes with fewer network ties.

-- TABLE 5.12 ABOUT HERE --

I account for these possibilities by comparing age homophily for first ties only and most recent ties only for all relationship types and then individually for each of the three types. Age assortativity coefficients when no distinction is made based on relationship type are approximately equal regardless of time point of relationship formation (all coefficients roughly equal to 0.73). Age assortativity coefficients by relationship type follow a slightly different pattern. Relative to the overall values for including all ties (i.e., regardless of whether a tie is the first or most recent) of a specific relationship type, age assortativity coefficients are higher when including only first time ties, but lower when including only most recent ties. This difference is most notable for "Married" ties where first marriages have a coefficient of 0.66, but remarriages have a coefficient of about 0.45. The lower assortativity coefficient for remarriages somewhat explains why "Married" ties have weaker age homophily compared to the other two relationship types.

When I initially distinguish between the three relationship types, age assortativity coefficients are higher for "Relationship" ties relative to "Encounter" and "Married" ties (0.71, 0.66, and 0.63, respectively). The tendency for connected nodes within the subsample to be of similar ages is strongest in "Relationship" ties, but slightly weaker in "Encounter" and "Married" ties. This pattern holds even when accounting for whether a tie is the first or most recent instance of a particular relationship type. First only "Relationship" ties have a higher age assortativity coefficient than first only "Encounter" and "Married" ties (0.72, 0.68, and 0.66, respectively). Thus, first only "Relationship" ties have the strongest age homophily, but this dynamic is slightly weaker in first only “Encounter” and “Married” ties. Most recent only “Relationship” ties have a higher age assortativity coefficient than most recent only “Encounter” and “Married” ties (0.70, 0.63, and 0.45, respectively). The tendency for connected nodes within the subsample to be of similar ages is therefore strongest in most recent “Relationship” ties, slightly weaker in most recent “Encounter” ties, and much weaker in most recent “Married” ties.

I find evidence of age homophily between partners in all relationship types and thus find support for Hypothesis 5 regarding homophily in marriage ties. Given the assortativity coefficients for “Relationship” and “Encounter” ties, I also find support for Hypotheses 7a and 9a which predicted age homophily in romantic/dating and short-term relationships, respectively. However, the level of age homophily in “Relationship” ties is not less than that in “Married” ties. This means Hypothesis 7b regarding less age homophily in romantic/dating than marriage ties is not supported. Although age homophily in “Encounter” ties is less than that in “Relationship” ties, it is not less than that in “Married” ties. This does not support Hypothesis 9c which expected less age homophily in short-term ties than in marriage ties, but does support Hypothesis 9b which expected less age homophily in short-term ties than in romantic/dating ties.

An interesting pattern emerges when accounting for relationship type, first and most recent ties, and gender of older partner. Table 5.13 shows age assortativity coefficients are highest when including only the most recent ties of all relationship types regardless of the gender of the older partner or whether partners are closer in age. However, age assortativity coefficients are higher when including only first ties for most combinations of relationship type and gender of older partner or whether partners are more age-matched. The exceptions to this trend are values for most recent older woman “Relationship” and most recent older woman “Encounter” ties which have higher assortativity coefficients. What is notable is the much lower coefficient values for most recent “Married” (i.e., remarriage) ties regardless of the gender of the older partner or whether partners are more similar in age. Thus, with the exception of most recent older woman “Relationship” and most recent older woman “Encounter” ties, age homophily appears to be strongest for initial ties when relationship type is taken into consideration. Similarly, the tendency for age homophily to weaken in later marriage ties is present for all variations of partner age pairing. The effect of remarriage ties involving more age-discrepant partners may somewhat explain why “Married” ties overall have lower age assortativity coefficients compared to “Relationship” and “Encounter” ties.

-- TABLE 5.13 ABOUT HERE --

5.3.4 Chi-squared Test Results

Table 5.14 displays frequencies of non-rumored and rumored ties for age gaps of 0-5, 6-10, 11-15, 16-20, 21-25, 26-30, and 31 or more years. For age differences of 6 or more years, rumored ties are less prevalent as the size of age gaps approaches the maximum value of 66 years age difference. In Hypothesis 11, I proposed an association between the relative size of age gaps and rumored ties. Table 5.15 displays the results of a Pearson’s chi-squared test of association with and without the Yate’s continuity correction applied. While I expected large age gaps of 10 or more years would be significantly associated with (and thus be especially likely to occur as) rumored ties, the chi-squared results do not support this. I therefore do not find support for Hypothesis 11.

-- TABLE 5.14 ABOUT HERE --

-- TABLE 5.15 ABOUT HERE --

5.3.5 Logit Results

I now turn my attention to the likelihood of a tie being rumored based on the presence and size of age gaps and gender of older partner as estimated via logistic regression models. I again use a categorical coding of relationship type such that only those ties labeled “Married,” “Relationship,” or “Encounter” are included. I use the absolute value of age gaps to indicate the presence and size of age differences. I reverse the coding for gender of older partner to focus on older woman-younger man ties and use older man-younger woman ties as the reference group.

Based on chi-squared tests of association, all relationship types and having an older female partner are individually statistically significantly associated with a tie being rumored (see Table 5.16 and Table 5.17).[23] Table 5.17 shows results from chi-squared tests of association for included predictor variables. These chi-squared tests of association reveal age gaps greater than or equal to 10 years are statistically significantly associated with “Relationship” and “Encounter” ties, but not “Married” ties. Chi-squared tests also show that having an older female partner is statistically significantly associated with all three relationship types. Thus, I include two interaction terms for the interaction between age gap and relationship type and older woman and relationship type.

-- TABLE 5.16 ABOUT HERE --

-- TABLE 5.17 ABOUT HERE --

Table 5.18 displays the results of the logistic regression model testing Hypotheses 12, 13, and 14 (Model 4). While I expected increasing age gaps would be a significant predictor of (and

[23] The chi-squared test result for the association between “Married” ties and a tie being rumored is likely a result of the fact that these ties are more easily confirmed (via marriage license records or other official documentation) and thus less likely to occur as or remain rumored.

thus be especially likely to occur as) rumored ties, the results for Model 4 do not support this. I therefore do not find support for Hypothesis 12.

-- TABLE 5.18 ABOUT HERE --

Moving from an older man-younger woman tie to an older woman-younger man tie increases the odds of a tie being rumored by a factor of 3.10 (significant at the p=0.001 level). Thus, a tie involving an older woman is a strong predictor of rumored status relative to when a tie involves an older man holding constant other factors. This provides support for Hypothesis 13 which predicted that older woman ties would be more likely to occur as rumored ties.

Interestingly, "Encounter" ties involving an older woman are not more likely to be rumored than those involving an older man. The coefficients for the interactions between relationship type and having an older female partner show that relative to "Married" ties involving older women, the odds of a tie being rumored decrease by a factor of 2.95 and 3.01 for "Relationship" and "Encounter" ties involving older women, respectively (significant at the p=0.001 level for both). Comparatively speaking, the odds are higher that a tie is rumored if it involves an older man and a short-term relationship. Thus, I do not find support for Hypothesis 14 which expected short-term ties involving older female partners would be more likely to occur as rumored relative to those involving older male partners.

Table 5.1 Sexuality by Gender for WDW Network (109,626 Nodes and 88,746 Edges) [a]

	Men		Women		Total	
Sexuality:	***n*:**	**%:**	***n*:**	**%:**	***n*:**	**%:**
Bisexual [b]	909	1.7	1,036	1.9	1,945	1.8
Gay/Lesbian	2,515	4.6	1,923	3.5	4,438	4.1
Straight	50,733	93.7	52,510	94.7	103,243	94.2
Total Obs:	**54,157**	**49.4**	**55,469**	**50.6**	**109,626**	**100.0**

Note: a Percent totals may not sum to 100.0% due to rounding error.

b Bisexual nodes have an egocentric sexuality score with an absolute value not equal to 1.

Table 5.2 Observed Network Values vs. Test Statistics for Random Tie Deletion Networks (1,000 Iterations; Two-tailed Significance Tests) [a]

Network Characteristic:	**Observed:**	**Rumored Tie Deletion** *Point Estimate*:	**Random Tie Deletion** *Mean*:	*z*:		*SE*:
# of 3-cycles	477	331	417.92	-7.54	***	0.36
# of 4-cycles	12,529	9,498	10,501.14	-5.16	***	6.14
# of Bisexual Nodes [b]	1,550	451	541.98	-12.47	***	0.31
Mean Sexuality [c]	0.91	0.90	0.90	7.42	***	0.00

Note: a Observed network values include 3,848 Rumored ties. Random tie deletion networks remove *n*=3,848 edges at random.

b Bisexual nodes have an egocentric sexuality score with an absolute value not equal to 1.

c Mean of External-Internal (EI) egocentric homophily scores (proportion of ties to partners of the same gender out of all ties).

* Significant at 0.01-level.

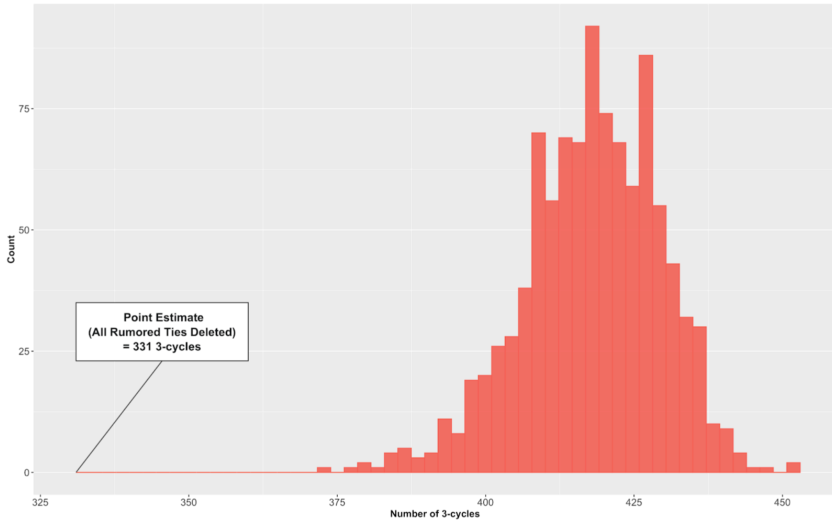
** Significant at 0.001-level.

*** Significant at 0.000-level.

Figure 5.1 Distributions from Random Tie Deletion Resampling (RTDR) Results [a]

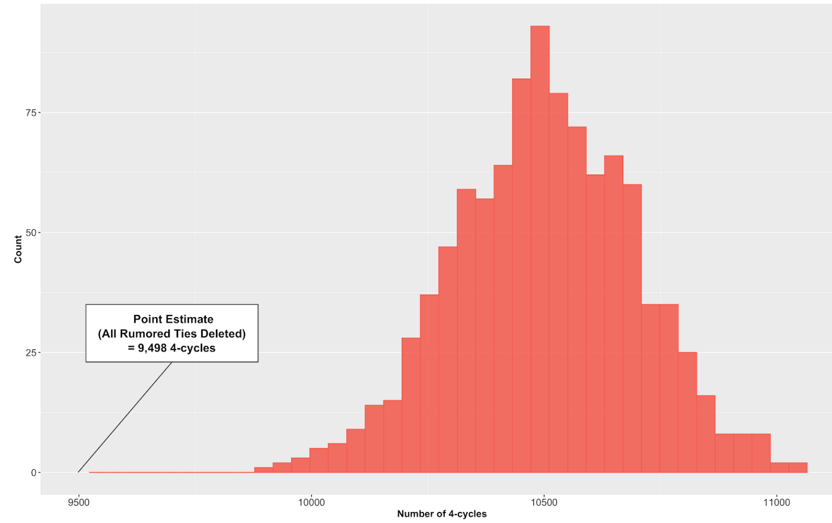
(a) Distribution of Number of 3-cycles in Random Tie Deletion Resampling (RTDR) Networks

x-axis expanded to include point estimate of 331 3-cycles when all rumored ties are deleted.



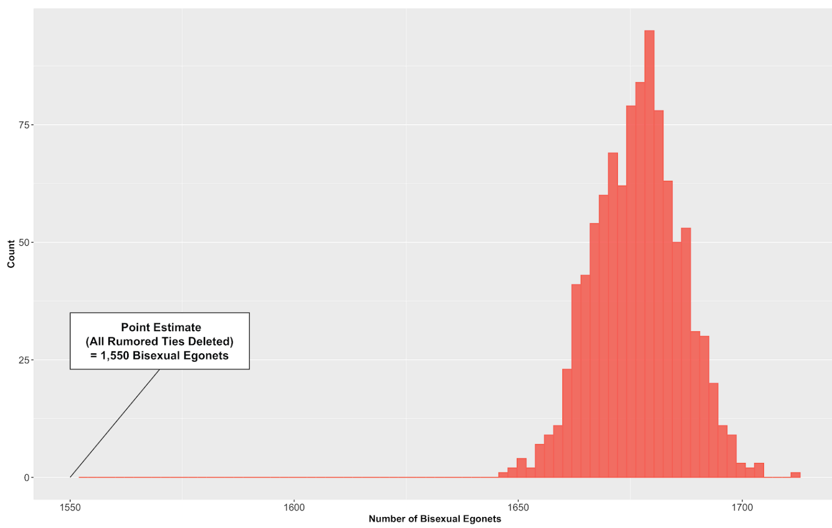
(b) Distribution of Number of 4-cycles in Random Tie Deletion Resampling (RTDR) Networks

x-axis expanded to include point estimate of 9,498 4-cycles when all rumored ties are deleted.



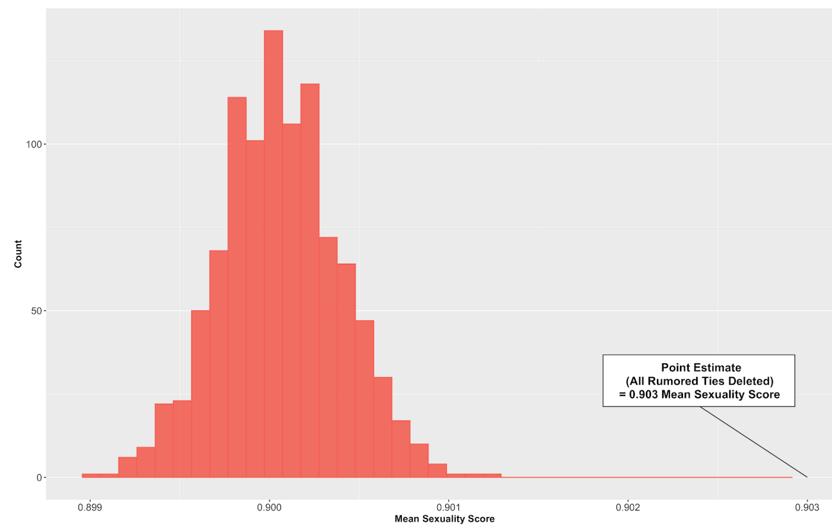
(c) Distribution of Number of Bisexual Egonets in Random Tie Deletion Resampling (RTDR) Networks [b]

x-axis expanded to include point estimate of 1,550 bisexual egonets when all rumored ties are deleted.



(d) Distribution of Mean Sexuality Scores in Random Tie Deletion Resampling (RTDR) Networks

x-axis expanded to include point estimate of 0.903 mean sexuality score when all rumored ties are deleted.



Note: a 1,000 iterations per distribution; Observed network values when all rumored ties are included are 477 3-cycles, 12,529 4-cycles, 1,784 bisexual egonets, and mean sexuality score of 0.906.

b Bisexual nodes have an egocentric sexuality score with an absolute value not equal to 1.

Figure 5.2 WDW Network 3-cycle Motifs by Node Gender and Edge Sexuality (477 3-cycles)

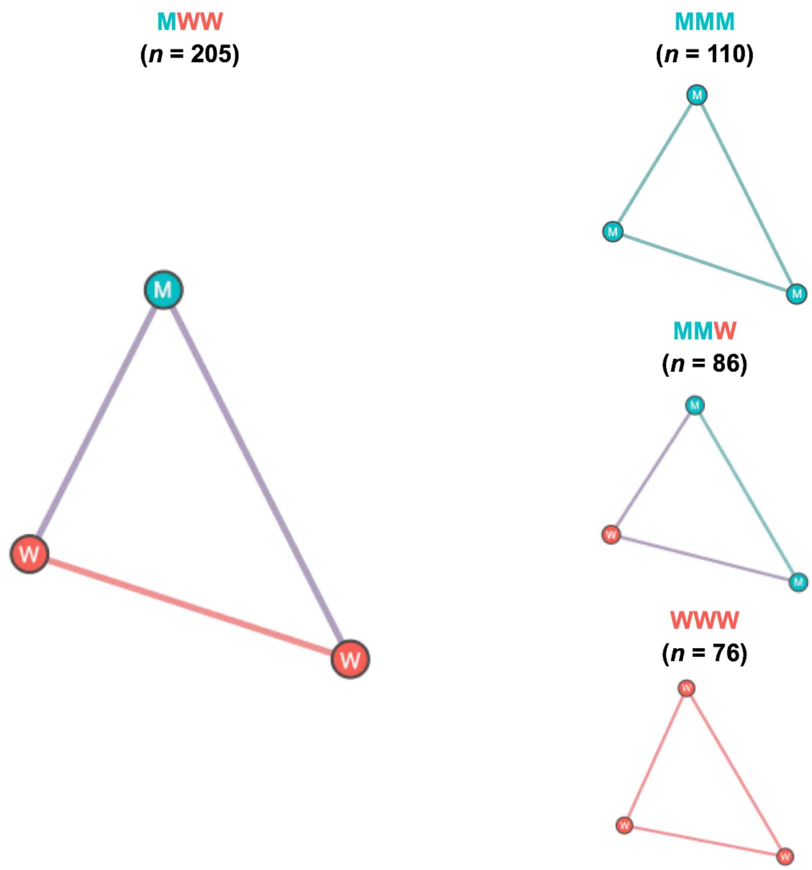
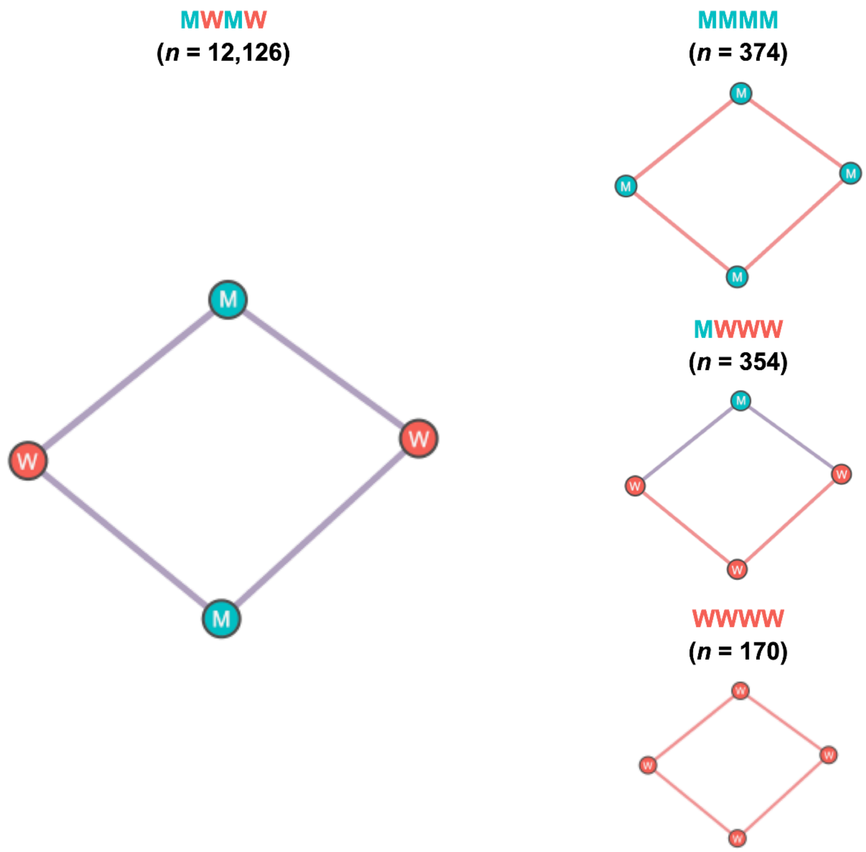


Figure 5.3 WDW Network 4-cycle Motifs by Node Gender and Edge Sexuality (13,609 4-cycles) [a]



Note: a Motifs displayed in figure do not include *n*=129 MWMM 4-cycles and *n*=26 MWWM 4-cycles.

Figure 5.4 WDW Network 3-cycle Motifs by Number of Rumored Ties (477 3-cycles)

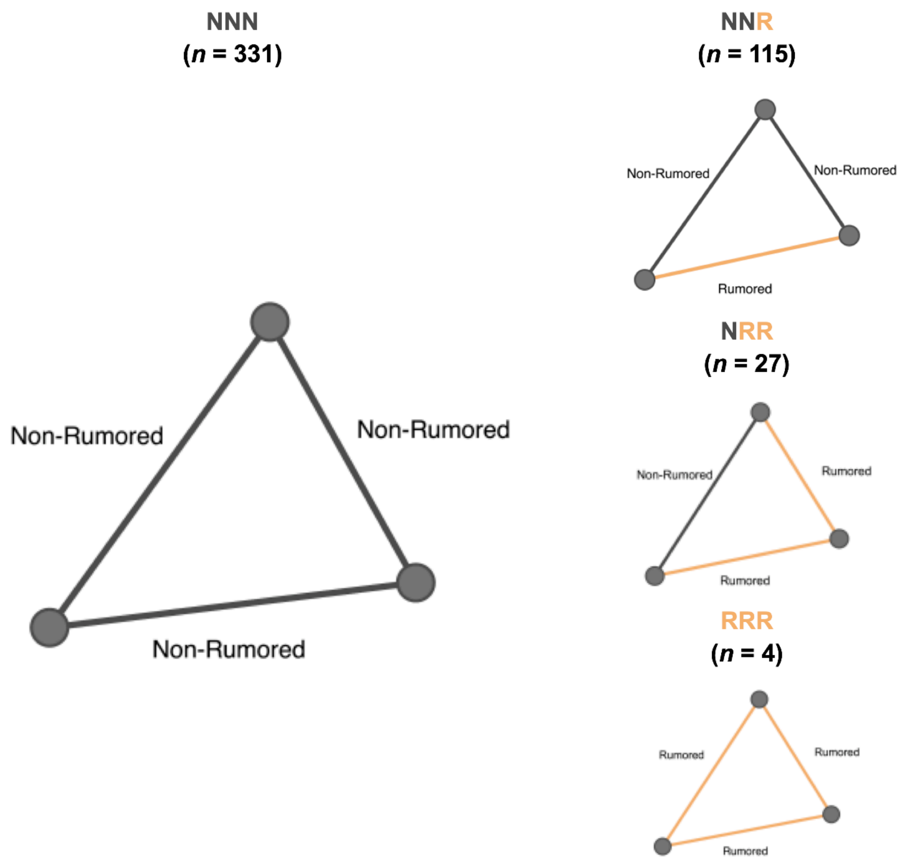
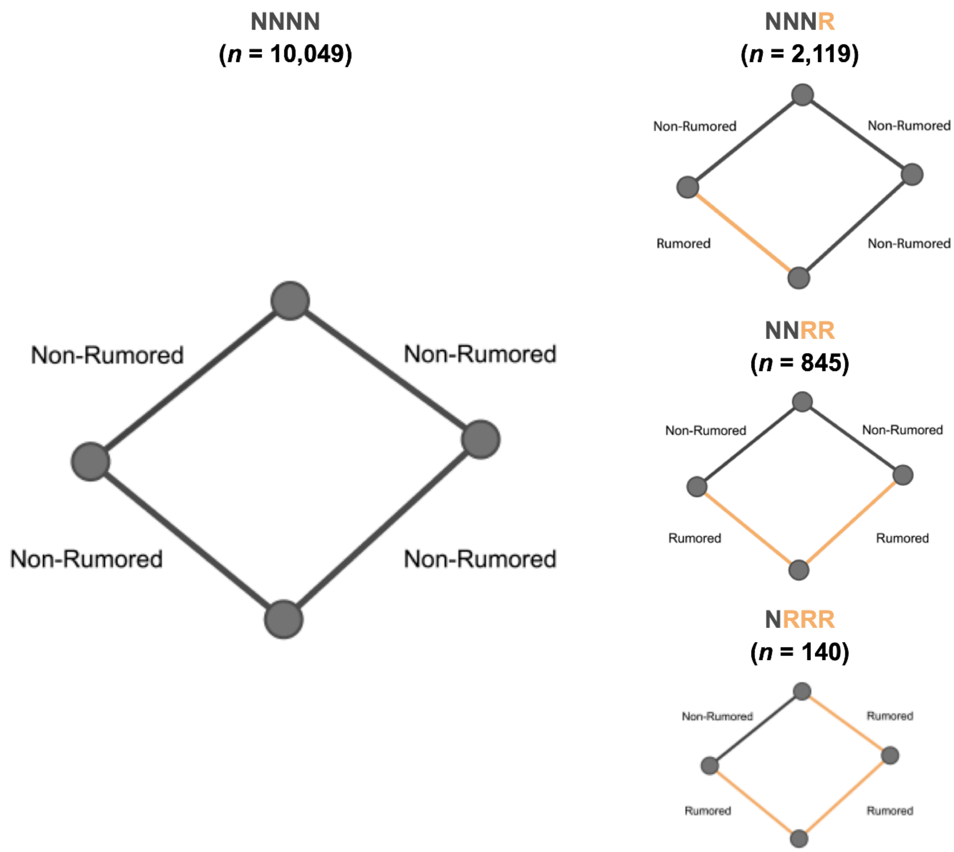


Figure 5.5 WDW Network 4-cycle Motifs by Number of Rumored Ties (13,609 4-cycles) [a]



Note: a Motifs displayed in figure do not include *n*=26 RRRR 4-cycles.

Table 5.3 Demographic Statistics for Age Gap Subsample (45,134 Nodes and 37,019 Edges) from WDW Network [a]

Demographic Characteristic:	**Count** *n*:	**Percent** %:	**Valid Percent** %:
Age: [b]			
≤ 25	1,360	3.0	3.0
26-45	16,598	36.8	36.8
46-65	12,980	28.8	28.8
66-85	10,443	23.1	23.1
≥ 86	3,753	8.3	8.3
Gender:			
Men	22,243	49.3	49.3
Women	22,891	50.7	50.7
Listed Sexuality:			
Bisexual	548	1.2	1.8
Disputed	124	0.3	0.4
Gay	69	0.2	0.2
Lesbian	42	0.1	0.1
Straight	30,381	67.3	97.5
NA	13,970	31.0	-
Total Obs:	**45,134**	**100.0**	**-**

Note: a Percent totals may not sum to 100.0% due to rounding error.

b Age as of 10/2020.

Table 5.4 Descriptive Network Statistics for Age Gap Subsample (45,134 Nodes and 37,019 Edges) from WDW Network With and Without Rumored Ties

Network Statistic:	With 1,979 Rumored Ties:	Without 1,979 Rumored Ties:
Network Order and Size:		
Nodes	45,134	44,335
Edges	37,019	35,040
n Nodes in Largest Component	15,542	13,901
% of Nodes in Largest Component	34.5%	31.4%
Short Cycles:		
4-cycles	3,589	3,339
Rumored Ties:		
n	1,979	0
%	5.4%	0.0%
Node Degree:		
Mean	1.64	1.58
Median	1.00	1.00
Maximum	54	51
Ego Network Homophily:		
Gini Coef. for Node Degree	0.33	0.31
Age Homophily	0.73	0.72

Table 5.5 Frequencies for Observed Age Gap Values in Age Gap Subsample (45,134 Nodes and 37,019 Edges) from WDW Network [a]

Age Gap Value: [b]	Count *n*:	Percent %:	Subtotal Percent %:
No Age Gap	2,612	7.1	7.1
Age Gap of 1-4 Yrs	14,501	39.2	46.2
Age Gap of 5-9 Yrs	9,477	25.6	71.8
Age Gap of 10-14 Yrs	4,928	13.3	85.1
Age Gap of 15-19 Yrs	2,505	6.8	91.9
Age Gap of 20-24 Yrs	1,319	3.6	95.5
Age Gap of 25-29 Yrs	696	1.9	97.4
Age Gap of 30-34 Yrs	353	1.0	98.3
Age Gap of 35-39 Yrs	190	0.5	98.8
Age Gap of 40-44 Yrs	95	0.3	99.1
Age Gap of 45-49 Yrs	74	0.2	99.3
Age Gap of 50-54 Yrs	49	0.1	99.4
Age Gap of 55-59 Yrs	40	0.1	99.5
Age Gap of 60-65 Yrs	28	0.1	99.6
Age Gap ≥66 Yrs	152	0.4	100.0
Total Obs:	**37,019**	**100.0**	**-**

Note: a Percent totals may not sum to 100.0% due to rounding error.

b Absolute age gap at time of tie formation, ages as of 10/2020.

Table 5.6 Frequencies, Means, and Medians for Age-Gapped Ties by Relationship Type, Gender of Older Partner, and Rumored Status in Age Gap Subsample (45,134 Nodes and 37,019 Edges) from WDW Network [a]

	Count	Percent	Age Gap Value [b]	
Edge Type:	***n*:**	**%:**	***Mean:***	***Median:***
All	45,134	100.0	7.95	5.00
Relationship Type:				
"Married"	16,948	45.8	8.00	5.00
"Relationship"	15,495	41.9	7.63	5.00
"Encounter"	4,227	11.4	9.04	6.00
"On-Screen"	5	0.0	9.60	10.00
"Unknown"	343	0.9	6.71	4.00
"NA"	1	0.0	0.00	0.00
Gender of Older Partner: [c]				
Older Man	16,337	44.1	13.36	10.00
Older Woman	3,569	9.6	11.96	8.00
Same Age or ≤4 Yrs Difference	17,113	46.2	1.95	2.00
Rumored:				
Rumored	22,243	49.3	7.79	5.00
Non-Rumored	22,891	50.7	7.96	5.00

Note: a Percent totals may not sum to 100.0% due to rounding error.

b Absolute age gap at time of tie formation, ages as of 10/2020.

c Older partner gender for any absolute age gap value ≥5 years difference.

Table 5.7 Frequencies, Means, and Medians for Relationship Tie Types by First and Most Recent Ties in Age Gap Subsample (45,134 Nodes and 37,019 Edges) from WDW Network [a]

	Count	Percent	Age Gap Value [b]	
Relationship Type:	***n*:**	**%:**	***Mean:***	***Median:***
All	45,134	100.0	7.95	5.00
First and Only	25,214	55.9	7.41	5.00
Most Recent Only	25,210	55.9	7.90	5.00
"Married:"				
All	16,948	45.8	8.00	5.00
First and Only	14,089	31.2	7.71	5.00
Most Recent Only	2,859	6.3	9.41	6.00
"Relationship:"				
All	15,495	41.9	7.63	5.00
First and Only	9,044	20.0	7.30	5.00
Most Recent Only	6,110	13.5	8.12	5.00
"Encounter:"				
All	4,227	11.4	9.04	6.00
First and Only	2,610	5.8	8.99	6.00
Most Recent Only	1,617	3.6	9.11	6.00

Note: a Percent totals may not sum to 100.0% due to rounding error.

b Absolute age gap at time of tie formation, ages as of 10/2020.

Table 5.8 Frequencies, Means, and Medians for Gender of Older Partner by Relationship Type and Rumored Status in Age Gap Subsample (45,134 Nodesand 37,019 Edges) from WDW Network [a]

	Gender of Older Partner [b]											
	Older Man				Older Woman				Same Age or ≤4 Yrs Difference			
	Count	Percent	Age Gap Value [c]		Count	Percent	Age Gap Value [c]		Count	Percent	Age Gap Value [c]	
Edge Type:	*n*:	%:	*Mean:*	*Median:*	*n*:	%:	*Mean:*	*Median:*	*n*:	%:	*Mean:*	*Median:*
All	16,337	44.1	13.36	10.00	3,569	9.6	11.96	8.00	17,113	46.2	1.95	2.00
Relationship Type:												
"Married"	7,717	20.8	13.26	10.00	1,384	3.7	13.18	8.00	7,847	21.2	1.91	2.00
"Relationship"	6,470	17.5	13.24	10.00	1,636	4.4	11.00	8.00	7,389	20.0	1.96	2.00
"Encounter"	2,028	5.5	14.20	11.00	507	1.4	11.65	9.00	1,692	4.6	2.07	2.00
"On-Screen"	2	0.0	17.50	17.50	1	0.0	10.00	10.00	3	0.0	1.50	1.50
"Unknown"	120	0.3	12.03	9.00	41	0.1	12.51	10.00	182	0.5	1.90	2.00
"NA"	0	0.0	-	-	0	0.0	-	-	1	0.0	0.00	0.00
Rumored:												
Rumored	839	2.3	13.06	10.00	240	0.6	11.10	9.00	900	2.4	1.99	2.00
Non-Rumored	15,498	41.9	13.38	10.00	3,329	9.0	12.02	8.00	16,213	43.8	1.95	2.00

Note: a Percent totals may not sum to 100.0% due to rounding error.

b Older partner gender for any absolute age gap value ≥5 years difference.

c Absolute age gap at time of tie formation, ages as of 10/2020.

Table 5.9 Frequencies, Means, and Medians for Gender of Older Partner by Relationship Type and First and Most Recent Ties in Age Gap Subsample (45,134 Nodes and 37,019 Edges) from WDW Network [a]

	Gender of Older Partner [b]											
	Older Man				Older Woman				Same Age or ≤4 Yrs Difference			
	Count	Percent	Age Gap Value [c]		Count	Percent	Age Gap Value [c]		Count	Percent	Age Gap Value [c]	
Relationship Type:	*n*:	%:	*Mean:*	*Median:*	*n*:	%:	*Mean:*	*Median:*	*n*:	%:	*Mean:*	*Median:*
All	16,337	44.1	13.36	10.00	3,569	9.6	11.96	8.00	17,113	46.2	1.95	2.00
First Ties Only	11,134	30.1	12.91	10.00	2,136	5.8	12.24	8.00	12,489	33.7	1.92	2.00
Most Recent Ties Only	10,589	28.6	13.35	10.00	2,311	6.2	11.99	8.00	11,765	31.8	1.93	2.00
"Married:"												
All	7,717	20.8	13.26	10.00	1,384	3.7	13.18	8.00	7,847	21.2	1.91	2.00
First Ties Only	6,216	16.8	13.01	10.00	1,112	3.0	13.38	8.00	6,761	18.3	1.91	2.00
Most Recent Ties Only	1,501	4.1	14.26	11.00	272	0.7	12.39	8.00	1,086	2.9	1.95	2.00
"Relationship:"												
All	6,470	17.5	13.24	10.00	1,636	4.4	11.00	8.00	7,389	20.0	1.96	2.00
First Ties Only Most	3,862	10.4	12.82	10.00	943	2.5	10.77	8.00	4,580	12.4	1.94	2.00
Recent Ties Only	2,608	7.0	13.86	10.00	693	1.9	11.32	8.00	2,809	7.6	2.00	2.00
"Encounter:"												
All	2,028	5.5	14.20	11.00	507	1.4	11.65	9.00	1,692	4.6	2.07	2.00
First Ties Only Most	1,252	3.4	14.21	11.00	289	0.8	11.92	9.00	1,069	2.9	2.09	2.00
Recent Ties Only	776	2.1	14.19	11.00	218	0.6	11.29	9.00	623	1.7	2.03	2.00

Note: a Percent totals may not sum to 100.0% due to rounding error.

b Older partner gender for any absolute age gap value ≥5 years difference.

c Absolute age gap at time of tie formation, ages as of 10/2020.

Table 5.10 Negative Binomial Logit Model Results Predicting Absolute Age Gap Value for Age Gap Subsample from WDW Network (Model 1 and Model 2)

	Model 1				Model 2			
Predictor Variable:	***Coef.*:**		***z*:**	***SE*:**	***Coef.*:**		***z*:**	***SE*:**
Intercept	2.04	***	262.49	0.01	2.01	***	248.63	0.01
From "Married" to "Relationship" tie	-0.03	**	-2.98	0.01	-		-	-
From "Married" to "Encounter" tie	0.15	***	8.43	0.02	-		-	-
From "Relationship" to "Encounter" tie	-		-	-	0.18	***	10.37	0.02
Model Fit Statistics:								
Null deviance	40,976				22,023			
(df)	*(36,669)*				*(19,721)*			
Residual deviance	40,867				21,912			
(df)	*(36,667)*				*(19,720)*			
AIC	227,776				122,552			
Number of Fisher Scoring Iterations	1				1			
Theta	1.11				1.14			
SE	0.01				0.01			
2x log-likelihood	-227,767.70				-122,546.17			

Note: * Significant at 0.01-level.

** Significant at 0.001-level.

*** Significant at 0.000-level.

Table 5.11 Zero-truncated Negative Binomial Logit Model Results Predicting Absolute Age Gap Value for Age Gap Subsample from WDW Network (Model 3)

	Model 3			
Predictor Variable: [a]	***Coef.*:**		***z*:**	***SE*:**
Intercept 1	2.43	***	206.90	0.01
Intercept 2	1.22	***	89.95	0.01
From "Married" to "Relationship" tie	-0.02		-1.61	0.01
From "Married" to "Encounter" tie	0.06	***	4.73	0.01
From "Older Woman" to "Older Man" tie	0.13	***	11.03	0.01
Model Fit Statistics:				
Log likelihood	-65,627.90			
(df)	*(39,479)*			
Number of Fisher Scoring Iterations	5			

Note: a No Hauck-Donner effect found in any of these estimates.

* Significant at 0.01-level.

** Significant at 0.001-level.

*** Significant at 0.000-level.

Table 5.12 Age Assortativity Coefficients for First and Most Recent Ties for Age Gaps Less than or Equal to 65 Years Difference in Age Gap Subsample

Relationship Type:	Age Assortativity Coefficient:	Nodes:	Edges:
All	0.725	45,125	37,012
First Only	0.729	40,830	25,108
Most Recent Only	0.732	40,783	25,110
"Married:"			
All	0.633	29,640	16,858
First Only	0.659	26,167	14,016
Most Recent Only	0.453	4,075	2,842
"Relationship:"			
All	0.714	18,284	15,443
First Only	0.722	14,107	9,368
Most Recent Only	0.700	6,477	6,075
"Encounter:"			
All	0.658	4,804	4,210
First Only	0.677	3,745	2,595
Most Recent Only	0.629	1,625	1,615

Table 5.13 Age Assortativity Coefficients for First and Most Recent Ties by Relationship Type and Gender of Older Partner for Age Gaps Less than or Equal to 65 Years Difference in Age Gap Subsample [a]

	Gender of Older Partner [b]								
	Older Man			Older Woman			Same Age or ≤4 Yrs Difference		
Relationship Type:	***Age Assortativity Coefficient*:**	***Nodes*:**	***Edges*:**	***Age Assortativity Coefficient*:**	***Nodes*:**	***Edges*:**	***Age Assortativity Coefficient*:**	***Nodes*:**	***Edges*:**
All	0.597	22,445	16,227	0.628	5,648	3,524	0.817	25,428	17,109
First Ties Only	0.613	18,437	10,521	0.622	3,932	2,102	0.823	22,179	12,485
Most Recent Ties Only	0.620	19,194	11,066	0.646	4,238	2,281	0.832	21,045	11,763
"Married:"									
All	0.524	14,023	7,665	0.559	2,618	1,350	0.731	15,035	7,843
First Ties Only	0.544	11,788	6,174	0.583	2,136	1,083	0.756	13,221	6,759
Most Recent Ties Only	0.411	2,450	1,491	0.412	498	267	0.513	1,911	1,084
"Relationship:"									
All	0.592	8,867	6,426	0.610	2,644	1,628	0.831	10,633	7,389
First Ties Only	0.605	6,327	3,846	0.600	1,709	942	0.831	7,715	4,580
Most Recent Ties Only	0.569	3,376	2,580	0.622	1,084	686	0.827	3,784	2,809
"Encounter:"									
All	0.541	2,595	2,014	0.587	800	504	0.804	2,434	1,692
First Ties Only	0.570	1,909	1,240	0.539	516	286	0.820	1,792	1,069
Most Recent Ties Only	0.496	952	774	0.648	328	218	0.779	829	623

Note: a Simplified network used for assortativity analysis includes 45,000 nodes and 36,867 edges.

b Older partner gender for any absolute age gap value ≥5 years difference.

Table 5.14 Frequencies for Rumored and Non-Rumored Ties by Observed Age Gap Values in Age Gap Subsample (45,134 Nodes and 37,019 Edges) from WDW Network [a]

	Rumored Ties		**Non-Rumored Ties**			**Subtotal**
	Count	**Percent**	**Count**	**Percent**	**Count**	**Valid Percent**
Age Gap Value: [b]	***n*:**	**%:**	***n*:**	**%:**	***n*:**	**%:**
Age Gap of 0-5 Yrs	1,025	2.8	18,550	50.1	19,575	52.9
Age Gap of 6-10 Yrs	442	1.2	7,865	21.2	8,307	22.4
Age Gap of 11-15 Yrs	243	0.7	4,001	10.8	4,244	11.5
Age Gap of 16-20 Yrs	138	0.4	2,093	5.7	2,231	6.0
Age Gap of 21-25 Yrs	56	0.2	1,105	3.0	1,161	3.1
Age Gap of 26-30 Yrs	34	0.1	581	1.6	615	1.7
Age Gap of 31-65 Yrs	38	0.1	696	1.9	734	2.0
Age Gap of ≥66 Yrs	3	0.0	149	0.4	152	0.4
Total Obs:	**1,979**	**5.4**	**35,040**	**94.7**	**37,019**	**100.0**

Note: a Percent totals may not sum to 100.0% due to rounding error.

b Absolute age gap at time of tie formation, ages as of 10/2020.

Table 5.15 Chi-squared Test Results for the Association Between Age Gaps Between 10-65 Years Difference and Rumored Tie Status in Age Gap Subsample

Test:	**Chi-squared Statistic:**	***p*-value:**	***df:***
Without Yates' Continuity Correction	3.06	0.08	1
With Yates' Continuity Correction	2.97	0.08	1

* Significant at 0.01-level.

** Significant at 0.001-level.

*** Significant at 0.000-level.

Table 5.16 Frequencies for Rumored and Non-Rumored Ties by Relationship Type and Gender of Older Partner in Age Gap Subsample (45,134 Nodes and 37,019 Edges) from WDW Network [a]

	Rumored Ties		**Non-Rumored Ties**			**Subtotal**
	Count	**Percent**	**Count**	**Percent**	**Count**	**Valid Percent**
Edge Type:	***n*:**	**%:**	***n*:**	**%:**	***n*:**	**%:**
Relationship Type:						
"Married"	15	0.8	16,933	48.3	16,948	45.8
"Relationship"	748	37.8	14,747	42.1	15,495	41.9
"Encounter"	1,046	52.9	3,181	9.1	4,227	11.4
"On-Screen"	5	0.3	0	0.0	5	0.0
"Unknown"	170	8.6	173	0.5	343	0.9
"NA"	0	0.0	1	0.0	1	0.0
Gender of Older Partner: [b]						
Older Man	839	42.4	15,498	44.2	16,337	44.1
Older Woman	240	12.1	3,329	9.5	3,569	9.6
Same Age or ≤4 Yrs Difference	900	45.5	16,213	46.3	17,113	46.2
Total Obs:	**1,979**	**5.4**	**35,040**	**94.7**	**37,019**	**100.0**

Note: a Percent totals may not sum to 100.0% due to rounding error.

b Older partner gender for any absolute age gap value ≥5 years difference.

Table 5.17 Chi-squared Test Results for the Association Between Relationship Type, Older Female Partner, Categorical Age Gap, and Rumored Tie Status in Age Gap Subsample [a]

	With Yates' Continuity Correction			Without Yates' Continuity Correction		
Test: [b]	***Chi-squared Statistic*:**	***p-value*:**	***df*:**	***Chi-squared Statistic*:**	***p-value*:**	***df*:**
Rumored tie and "Married" tie	1700.60 ***	0.00	1	1702.50 ***	0.00	1
Rumored tie and "Relationship" tie	14.49 ***	0.00	1	14.67 ***	0.00	1
Rumored tie and "Encounter" tie	3544.60 ***	0.00	1	3548.90 ***	0.00	1
Rumored tie and "Older Woman" tie	14.53 ***	0.00	1	14.84 ***	0.00	1
Categorical Age Gap and "Married" tie	0.32	0.57	1	0.33	0.56	1
Categorical Age Gap and "Relationship" tie	32.29 ***	0.00	1	32.42 ***	0.00	1
Categorical Age Gap and "Encounter" tie	70.51 ***	0.00	1	70.82 ***	0.00	1
"Older Woman" tie and "Married" tie	92.85 ***	0.00	1	93.21 ***	0.00	1
"Older Woman" tie and "Relationship" tie	52.02 ***	0.00	1	52.29 ***	0.00	1
"Older Woman" tie and "Encounter" tie	9.16 **	0.00	1	9.33 **	0.00	1

Note: a Absolute age gap at time of tie formation, ages as of 10/2020.

b Older partner gender for any absolute age gap value ≥5 years difference.

* Significant at 0.01-level.

** Significant at 0.001-level.

*** Significant at 0.000-level.

Table 5.18 Binomial Logit Model Results Predicting Rumored Tie Status for Age Gap Subsample from WDW Network (Model 4) [a]

	Model 4			
Predictor Variable:	***Coef.*:**		***z*:**	***SE*:**
Intercept	-9.23	***	-8.56	1.08
Absolute Age Gap Value	0.02		0.75	0.03
From "Married" to "Relationship" tie	6.28	***	5.80	1.08
From "Married" to "Encounter" tie	8.16	***	7.55	1.08
From "Older Man" to "Older Woman" tie	3.10	**	2.77	1.12
Absolute Age Gap Value *x* "Relationship" tie	-0.02		-0.89	0.03
Absolute Age Gap Value *x* "Encounter" tie	-0.03		-0.97	0.03
"Relationship" tie *x* "Older Woman" tie	-2.95	**	-2.62	1.13
"Encounter" tie *x* "Older Woman" tie	-3.01	**	-2.68	1.13
Model Fit Statistics:				
Null deviance	8007.50			
(df)	*(19,741)*			
Residual deviance	6038.10			
(df)	*(19,733)*			
AIC	6056.10			
Number of Fisher Scoring Iterations	11			

Note: a 16,928 observations deleted due to missingness.

* Significant at 0.01-level.

** Significant at 0.001-level.

*** Significant at 0.000-level.

CHAPTER 6

Discussion and Conclusion

6.1 Returning to the Research Hypotheses

I pause here to give a brief overview of my analytic results and the norms highlighted by my key findings before discussing potential theoretic implications. In Analysis 3, I predicted that the WDW network would follow patterns observed in the literature on age gaps based on relationship type. This pattern constructs a norm wherein age gaps are generally smaller in more long-term relationships with high levels of partner investment and commitment, but larger in short-term relationships with low investment or commitment. The associated network effect of this pattern would be more age homophily for long-term relationships (such as cohabitation or marriage) than in short-term relationships (such as dating or primarily sexual hook-ups). Similarly, age gaps should increase in size as relationship investment and commitment decrease such that short-term sexual ties have larger age gaps than either romantic/dating or marriage ties. I do not find support for Hypothesis 6 predicting romantic/dating ties would be more strongly associated with large age gaps than marriage ties. However, I find statistically significant support for Hypotheses 8a and 8b which predicted large age gaps would be more strongly associated with short-term ties than romantic/dating or marriage ties.

The WDW network subsample aligns with normative expectations wherein large age gaps are more strongly associated with and more numerous when men are the older partner (Hypothesis 10) and when relationships are short-term "Encounter" ties. A tie being labeled "Relationship" or "Encounter" is one of the most reliable predictors of having more age-gapped ties. This means the network also aligns with the expected pattern for short-term relationships to frequently involve age gaps. However, age gaps in the network subsample vary somewhat from what would be expected based on existing literature about age homophily by relationship type. For instance, there is a strong tendency for connected nodes to be of similar ages (i.e., to exhibit age homophily) and this tendency is at least moderate for the three relationship types. This provides support for Hypotheses 5, 7a, and 9a which predicted age homophily for partners in marriage, romantic/dating, and short-term ties, respectively. While the existing literature would expect age homophily to be strongest in marriage ties, I do not observe this in the WDW network where "Married" ties had less age homophily than short-term relationship types. These findings do not support Hypothesis 7b (that there will be less age homophily in romantic/dating than in marriage ties) or Hypothesis 9c (that there will be less age homophily in short-term than marriage ties). However, the age assortativity coefficient for "Encounter" ties is lower than that for "Relationship" ties which supports Hypothesis 9b's prediction of less age homophily in short-term ties relative to romantic/dating relationships.

Analysis 3 also examined associations between a tie being rumored, relationship type, and the involvement of an older woman. There is no statistically significant association between a tie having a large age gap of 10 or more years and being rumored. This refutes Hypothesis 11 which predicted large age gaps would be more likely to occur as rumored ties relative to smaller age gaps. Similarly, logistic regression coefficients show that increasing age gap values are not a statistically significant predictor of rumored ties. These results do not support Hypothesis 12 which expected ties would be more likely to be rumored as age gap increases. Additionally, in contrast to Hypothesis 14 "Encounter" ties involving an older woman are not more likely to be rumored than those involving an older man. Regression model results show, however, that involvement of an older woman is a statistically significant predictor of a tie being rumored. This supports Hypothesis 13's prediction that older woman-younger man ties would be more likely to occur as rumored ties compared to older man-younger woman ties and points to potentially greater counter-normativity of the former pairing.

Analysis 2 revealed that the most frequent combinations for gender and edge sexuality in network 3-cycles involve two opposite-sex ties and one same-sex tie between two women and one man. Network 4-cycles involving only opposite-sex ties between two women and two men are the most common motif for this structure. In both 3- and 4-cycles, the most common motifs for rumored ties are for these links to make up a fraction of involved edges (two non-rumored and one rumored tie in 3-cycles, three non-rumored and one rumored tie in 4-cycles).

In Analysis 1, I find statistically significant support for my four hypotheses predicting that rumored ties would be associated with more network short cycles, more bisexual nodes, and lower overall network sexuality. Rumored ties are disproportionately involved in 3- and 4-cycles which violates normative expectations to avoid "over-closeness" in romantic and sexual relationship networks. "Over-closeness" occurs when two or more individuals have overlap in their partnership histories which allows connected people to go from themselves and back in a handful of steps (Bearman et al 2004). Rumored ties also contribute to more bisexual nodes and frequently occur as discordant ties contradicting a node's individual-level heuristic for partner selection. The normative expectation is for individuals to avoid "discordance" and maintain a consistent pattern of partner selection based on their sexuality (i.e., straight nodes with opposite-gender ties, gay or lesbian nodes with same-gender ties, bisexual nodes with mixed-gender ties). Violations of this norm against "discordance" within one's partnership history contribute to more nodes with a pattern of mixed-gender tie formation and thus more bisexual nodes. Similarly, rumored ties contribute to lower overall network sexuality and frequently occur as discordant ties in a primarily heterosexual network. When the expectation to avoid "discordance" in a primarily heterosexual network is violated this lowers overall network sexuality by increasing the number of same-gender relationships involving otherwise straight people.

6.2 Investigating Potential Mechanisms for the Association between Rumored Ties and Network Structure

While the RTDR results from Analysis 1 point to some associations between rumored ties, short cycles, and network sexuality, these do not lend as much insight into the potential mechanisms for this association. We may be aware of normative expectations and use rumored ties to highlight potential transgressions, but is there any underlying logic to which claims are offered? If one goal of rumored ties is to generate salacious interest, it may be that those creating these links must strike a balance between the plausibility and recognizability of these claims. In order to seem plausible, rumored ties must involve some perceived degree of truth, source credibility, or likelihood of occurring (Bergmann 1993:98-99,102-103; Fine and Rosnow 1978:162; Pendleton 1998:75-76,78). But, in order to be recognizable and garner attention, these claims may need to invoke relatively simple expectations or norms. For example, claiming a romantic link between two people who were alive at the same time is not necessarily salacious – it's perfectly plausible and doesn't violate a recognizable norm (e.g., the marriage between Marilyn Monroe and Joe DiMaggio). On the other hand, claiming two romantically linked people engaged in some unexpected behavior might be salacious if the norm is recognizable even if the action isn't entirely plausible (e.g., a lesbian hook-up between an avowedly straight Marilyn Monroe and Marlene Dietrich).[24] In the WDW network, there are more short cycles

[24] Assessments of recognizability, plausibility, and salaciousness may vary over time or even by birth cohort. For instance, there's been a marked increase in the number of self-identified bisexuals among those born during or after

when rumored ties are included which may indicate some concerted focus on the expectation to avoid salacious "over-closeness." However, the "over-closeness" prohibition may suffer from "errors of reception" (Alfano and Robinson 2017:483) as this rule is not immediately obvious to most people (Bearman et al 2004:75). This may imply that the salaciousness of rumored ties also depends on the extent to which these ties elicit considerations of conformity (Pendleton 1998:80) via the recognizability of alleged counter-normativity (Pendleton 1998:74). To test this, I use the RTDR method to calculate *z*-scores for two equally plausible tie types that vary based on the recognizability of normative expectations.

The first of the two tie types are those considered incompatible based on astrological signs (i.e., zodiac signs). Although many people know their zodiac sign (88.0% of n=1,005 Americans surveyed by IPSOS; IPSOS 2019), a smaller percentage may actually believe in or consider astrology to be "sort of" or "very" scientific (36.5% of n=8,553 2006-2018 GSS respondents; see Healy 2019). Those interested in celebrity gossip or maintaining profiles on WDW may have characteristics associated with greater interest in or awareness of astrological norms. According to 2006-2018 GSS survey data, 43.1% of respondents under 40 saw astrology as "sort of" or "very" scientific (32.4% of 2006-2018 GSS respondents 41 and older saw astrology as "sort of" or "very" scientific; see Healy 2019). GSS responses to this question broken down by gender show fewer male than female respondents perceived astrology as "sort of" or "very" scientific (31.9 and 40.1% of male and female 2006-2018 GSS respondents, respectively; see Healy 2019). While the user base for WDW is relatively young (47.6% between 18-34; Similarweb 2023), it is also mostly male (57.2% male users; Similarweb 2023). Thus,

1980 (IPSOS 2021; Jones 2021). For more recent birth cohorts, even accusations of same-sex ties between men may not read as particularly salacious given this increased identification with and acceptance of LGBTQIA+ identities.

potential selection effects for interest in or awareness of zodiac expectations may balance out given the site's user demographics.

Incompatible zodiac ties may not generate significant *z*-scores if the modal person does not see these ties as countering any recognizable expectations. Hearing that a Scorpio man is dating a Gemini woman is unlikely to set off alarm bells for most people because this requires deeper knowledge of astrology and zodiac norms. A Scorpio (Water sign)-Gemini (Air sign) relationship may only be notable to people who know Water and Air signs are generally considered romantically incompatible based on zodiac elements (Kelly 2022). However, hearing that the Scorpio-Gemini tie in question is between 48-year-old actor Leonardo DiCaprio and 25-year-old model Vittoria Ceretti would be seen as counter-normative by most people due to the 20+ year age gap between DiCaprio (born 1974) and Ceretti (born 1998, DiDonato 2014; Collisson and De Leon 2018:2110-2111). I focus on ties involving age gaps between partners as the second tie type in my supplemental analysis. As previously noted, the acceptability of age-gapped relationships may be a function of the size of the age difference such that larger gaps are seen as less acceptable (Banks and Arnold 2001). Compared to zodiac signs, age-discrepant relationships invoke a simpler expectation to avoid age heterophily which may make these ties more obviously counter-normative when they occur. Although the recognizability of larger age gaps may increase perceived salaciousness, it could also undermine the plausibility of these ties. This may make rumored ties about larger age gaps less interesting or less likely to persist as they may be perceived as less likely to have occurred at all. Overall, I expect smaller age-gapped ties will have *z*-scores closer to statistical significance relative to the *z*-scores for zodiac element incompatibility and larger age-gapped ties.

To maintain a consistent sample in my supplemental analysis, I focus on edges wherein both ego and alter node have at least the month and day in date of birth information. This subset contains 69.8 and 59.4% of all initial network nodes and edges (*n*=76,502 nodes of the initial 109,626 nodes and *n*=52,714 edges of the initial 88,746 edges, respectively). One potential caveat of assessing a subset of ties with more complete date of birth information is that these individuals may be more well-documented because they are more notable which might also make them distinct in other ways. However, the percentage of rumored ties among edges with at least the month and day in date of birth information is not substantially higher than the percentage of rumored ties in the full sample (6.1% in the supplemental analysis sample versus 4.3% in the full sample, respectively). Likewise, this subsample is similar to the full sample on key descriptive characteristics such as: (a) mean degree (k_i) or mean number of partners (1.87 and 1.62 for the supplemental analysis subsample and full sample, respectively; both medians equal to 1.00); (b) percent bisexual nodes (2.5 and 1.8% bisexual nodes in the supplemental analysis subsample and full sample, respectively); and (c) mean sexuality score (0.91 for both samples; both medians equal to 1.00). Thus, I assume the subset of ties wherein ego and alter nodes have at least the month and day in date of birth information is similar to the full network sample.

To assess astrology norms, I first label all nodes with their respective zodiac sign (Aries, Aquarius, Cancer, Capricorn, Gemini, Leo, Libra, Pisces, Sagittarius, Scorpio, Taurus, or Virgo; Britannica 2023) and the zodiac element of their signs (Air, Earth, Fire, or Water; Kelly 2022). I then calculate the percent of subsample ties that are incompatible based on zodiac element (i.e., ties that pair Air (Aquarius, Gemini, Libra) or Fire (Aries, Leo, Sagittarius) signs with Earth

(Capricorn, Taurus, Virgo) or Water (Cancer, Pisces, Scorpio) signs; Kelly 2022). The subsample is roughly evenly split between the four zodiac elements (see Table 6.1).

I examine potential age heterophily norms by calculating the absolute value of age differences between partners and then measuring the proportion of ties with age gaps falling within different ranges (mean and median absolute value of age gaps equal to 7.95 and 5 years difference, respectively). Given potential variation in the counter-normativity of an age-gapped tie based on the size of the difference (Lehmiller and Agnew 2011), I count the percent of subsample ties with age gaps of 0, 1-5, 6-10, 11-15, and 16 or more years difference (6.7, 44.5, 22.6, 11.9, and 14.2% of subsample ties, respectively).

-- TABLE 6.1 ABOUT HERE --

Table 6.2 shows RTDR results for zodiac element incompatibility and age gaps for the supplemental analysis subsample. As expected, the *z*-score for zodiac element incompatibility does not reach statistical significance. Even though these ties are completely plausible, the use of zodiac incompatibility may be too obscure to signal salaciousness if the counter-normativity is not immediately obvious to the average observer. In contrast to the zodiac element incompatibility *z*-score, two *z*-scores for age gaps in the subsample approach, but do not reach statistical significance (age gaps of 1-5 and 11-15 years difference). Similarly and as expected, *z*-scores for smaller age gaps (1-5 years difference) are closer to statistical significance than *z*-scores for zodiac element incompatibility and larger age gaps (6-10 years, 11-15 years, and 16 or more years difference). Notably, there is no difference in the percentage of age gaps at the extreme end of age differences when rumored ties are included. This may be due to assessments of this particular variation on counter-normative age pairing as less plausible despite the potentially pronounced salaciousness of these ties. Additionally, it may be that relationships with large age differences are more likely to have some verification (e.g., these are marriage ties or produce children) and thus are eliminated from categorization as rumored. Alternatively, rumored age gaps in a network of celebrities may be relatively less interesting if these are assumed to be a common occurrence. The *z*-score for the percentage of ties with no age gap indicates a higher percentage of these edges when rumored ties are included. Ties with no age gap are likely the most plausible of all age-based edges, but they do not involve an age discrepancy which makes them the least salacious based on age difference alone. However, these ties are counter-normative relative to the established heuristic for age-gapped ties in the network having an average difference of 7.95 years. This may indicate additional contextual factors at work for rumored ties between nodes of the same age (e.g., those in the same career phase or occupational industry such as film co-stars or music collaborators).

-- TABLE 6.2 ABOUT HERE --

Compared to zodiac element incompatibility, age gaps may be more effective in signaling salaciousness as this form of counter-normativity is more recognizable to the average observer. Based on the pattern of age-gapped ties having on average roughly 8 years difference, rumored ties involving smaller age gaps (or even no age gap at all) would seem to go against this heuristic in the WDW dating network. When added to the findings from my initial three analyses, it seems rumored ties involve some negotiation of plausibility and recognizability to attain salaciousness as well as a hierarchy for invoked counter-normativity.

6.3 Discussion

The potential hierarchy for invoked counter-normativity and negotiations between plausibility, recognizability, and salaciousness illustrates an underlying logic or structure of rumored ties. Again, gossip and rumors about celebrity relationship ties may involve three key components: recognizability, plausibility, and salaciousness. Recognizability may depend on the simplicity, obviousness, or ease of understanding associated with the underlying norm (Alfano and Robinson 2017:483; Pendleton 1998:74). Plausibility may involve some assessment of source credibility or whether and how much the alleged actions are within the realm of possibility (Bergmann 1993:98-99,102-103; Fine and Rosnow 1978:162; Pendleton 1998:75-76,78). Finally, the salaciousness of rumor and gossip may depend on whether a claim generates interest, how observers immediately react to it, or the extent to which the alleged actions are perceived as scandalous (Allport and Postman 1947:502; Bergmann 1993:98-99; Peterson and Gist 1951:160). As with gossip and rumor, rumored ties must have some degree of truth to seem plausible and must violate some normative expectation to be salacious. But, before a tie can attain either plausibility or salaciousness, the underlying norm must be recognizable to most onlookers.

There may be some variation in the application of tie formation norms based on recognizability. Highly recognizable norms like acceptable age gaps or ties aligning with someone's sexual orientation are obvious and require little explanation or background information. In contrast, less recognizable norms such as zodiac element incompatibility or "over-closeness" avoidance might require additional context or remain unclear even with concerted explanations. Simpler, more obvious rules with greater recognizability are likely more frequently invoked than complicated, more obscure rules with less recognizability.

Yet, even for recognizable norms, there may be some consideration of plausibility such that rumor and gossip focus on pairings that are more likely to have occurred. Counter-normative structures may be prevalent in the WDW celebrity network because rumored ties frequently link those in adjacent social circles or those with real-world proximity who may already be more likely to have overlapping relationship histories (e.g., film co-stars).[25] Selecting from nearby alters would lend plausibility to rumored ties between proximal network actors such that most observers could see the tie as likely to form. A reasonable degree of plausibility and recognizability may additively contribute to the perceived salaciousness of any counter-normativity invoked by rumored ties. Striking a perfect balance between these three factors when constructing rumored ties invites fascination or prurient interest rather than immediate questioning or rejection of the tie's validity.

There may also be some negotiation to balance the plausibility and salaciousness of rumor and gossip which becomes measurable within networks. For instance, it makes sense that completion (rather than wholesale construction of) short cycles is the most common motif for rumored tie inclusion in these structures. A short cycle composed entirely of rumored ties would be highly salacious, but also highly improbable compared to a short cycle involving one or two rumored ties. This reiterates that rumored ties may be applied strategically to achieve salaciousness and plausibility. Similarly, findings from Analysis 1 and 2 show rumored ties contribute to more bisexual nodes in the network and short cycles involving bisexual nodes are fairly common. Motifs involving bisexual women are more common than those involving bisexual men and this may be due to assumptions of women's greater sexual fluidity (Kinnish, Strassberg, and Turner 2005).

Assumptions about sexual fluidity may result in the perception of same-sex ties among women as highly plausible, but minimally salacious while same-sex ties among men are less plausible, but highly salacious. If sexuality is conceptualized as an individual's "unique pattern

[25] Structurally, this would mean the distance between nodes in connected subgroups should be lower when including rumored ties or rumored ties should be concentrated amongst a core group of nodes.

of sexual and romantic desire, behavior, and identity" (Lehmiller 2014:145), we can further specify two key dimensions of sexuality. These two dimensions can be represented in network analysis as sexual behavior (i.e., partners someone engages with or forms ties to) and correlated sexual identity (i.e., how someone's sexuality could be identified based on observed behavior; Englert and Dinkins 2016:6).[26] Early interpretations of sexuality as existing on a spectrum such as in the Kinsey sexuality scale (Kinsey, Pomeroy, and Martin 1948; see also Englert and Dinkins 2016:22) allowed for various combinations of same- and opposite-sex attraction. More recent assessments consider variation in multiple dimensions of sexuality as indicative of potential sexual fluidity.

"Sexual fluidity" is defined as the "capacity for situation-dependent flexibility in sexual responsiveness which allows individuals to experience changes in same-sex or other-sex desire across both short-term and long-term periods" (Diamond 2016:249). This flexibility may impact an individual's sexual attraction, self-identification, identity, or behaviors in partner selection over their life span (Diamond 2016:249). Sexual fluidity can be thought of more simply as any measurable changes in an individual's behavior, self-identification, and partnership patterns that "flatly contradict prevailing assumptions" about their sexual orientation (Diamond 2008:2; see also Baumeister 2000; Kinsey et al 1948). These changes may occur in response to various sociocultural (Baumeister 2000) or situational sexual stimuli (Chivers et al 2004) with the scale and magnitude of change varying between individuals.

The existence of sexual fluidity "indicates that sexual orientation does not rigidly predict" desire and attraction over one's lifespan as this characteristic varies between individuals

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[26] Insight into sexual attraction as a third dimension of sexuality (Englert and Dinkins 2016:6) is limited for network analysis without supplemental qualitative data; thus, I focus on the first two dimensions instead.

(Diamond 2016:249-250).[27] According to Diamond, "one of the most significant unanswered questions regarding sexual fluidity concerns gender differences" (Diamond 2016:249). Early studies in Western nations have suggested that compared to men, women have a greater capacity to exhibit sexual fluidity (Kinnish et al 2005), "nonexclusive" sexual attractions (Diamond 2016:250), bisexuality (Kinnish et al 2005; Weinberg, Williams, and Pryor 1994), and sexual or erotic plasticity (Baumeister 2000; Baumeister 2004). Indeed, women's sexual or erotic plasticity or "the extent to which the sex drive can be shaped by social, cultural, and situational factors" (Baumeister 2004:133) may make women's sexuality especially susceptible to changes over time or in response to various attitudinal, situational, and sociocultural constraints (e.g., fewer eligible partners of a preferred sex, need for companionship or domestic assistance, etc.; Baumeister 2000; Kinnish et al 2005:174). This pattern may persist regardless of women's sexual orientation as both lesbian and straight women have reported greater flexibility than their male counterparts in terms of sexual fantasy and romantic attraction (Kinnish et al 2005:179).

Assumptions about women's greater sexual fluidity may impose gendered constraints on discordant tie claims which must balance the plausibility and salaciousness of rumor and gossip. Potential or perceived variation in the persistence of women's same-sex attraction (Diamond 2016:253) may lead to interpretations of less stable sexual orientations such that at a baseline most women are assumed to be straight with a moderate capacity for bisexuality (Kinnish et al 2005:177; see also Klein, Sepekoff, and Wolf 1985). The baseline man, however, is presumed to be either exclusively straight or exclusively gay (Kinnish et al 2005:174). Greater sexual fluidity

[27] It could also be argued that bisexuality as an identified sexual orientation is indistinguishable from "nonexclusive sexual attractions" or the capacity for "erotic responsiveness" to those of the same and opposite sex (Diamond 2016:250). However, nonexclusive sexual attraction is more appropriately conceptualized as context-dependent and sporadic whereas bisexuality is a consistent pattern of "mixed attractions" (Diamond 2016:250). This distinction is less concerning for network analysis as individuals with a greater capacity for sexual fluidity and individuals whose sexual orientation has developed over time could still have equally mixed tie formation patterns in their relationship histories.

in women (or even simply the perception of this) may influence constructions of plausible ties in gossip and rumors such that women are frequently linked in relationships that are discordant with their existing partnership histories. In a primarily straight network such as the WDW celebrity network, this would mean otherwise straight women appear behaviorally bisexual due to frequent involvement in rumored same-sex ties. Rumored same-sex ties would also increase the likelihood of women being included in 3-cycles such that female bisexuality is key for building these structures. A 3-cycle involving two women and one man may be only moderately salacious, but it may have greater plausibility given assumptions regarding women's sexual fluidity. If men are assumed to have more static or stable sexualities (Kinnish et al 2005), then it makes sense that they are less frequently involved in short cycles as bisexual nodes or via discordant ties.

Notions about gendered sexual fluidity lend insight into potential hierarchies of counter-normativity influencing the construction of rumored ties. These hierarchies may align with broader social expectations and limit which behaviors are allowed as topics of discussion. For example, male bisexuality would be highly salacious, but a hierarchy of counter-normativity may make allegations about this less plausible (and potentially more taboo) than claims about female bisexuality. More recent findings show some degree of sexual fluidity (or at least an increased willingness to claim or identify it under certain circumstances; Clarke, Marks, and Lykins 2015) may also be present in men (Diamond 2016:249; Diamond 2008; Mishel et al 2020). However, the most common finding about men's sexual fluidity is a lack thereof with men describing their sexuality as a more stable, "continuous and unchanging orientation" (Kinnish et al 2005:174,178-179; see also Diamond 2000, Diamond 2003; Haldeman 1994:222; Henderson 1984:217; Katz-Wise 2015).

Even if men have a similar (or at least not insignificant) capacity for sexual fluidity, their acknowledgment and expression of same-sex attraction may be more greatly constrained by prevailing heteronormative assumptions. Claims regarding gay or bisexual identities may be more greatly sanctioned when these statements involve men compared to when they involve women (Mize and Manago 2018; Yost and Thomas 2012). Strong taboos against "outing" gay, bisexual, or trans men who have not publicly confirmed their sexual orientation or gender identity also exist (Brener 2017; Petrow 2013). Additionally, gendered interpretations of sexuality show straight men express more prejudiced attitudes toward gay people relative to straight women (Herek 2010). Attitudinal studies have shown that both men and women express more biphobia when the target individual is a bisexual man rather than a bisexual woman (Clarke et al 2015; Yost and Thomas 2012). Similarly, cultural biphobia and homophobia may be acutely targeted toward men such that male same-sex relations are more consequential or more actively policed than female same-sex relations (Diamond 2016:252; Mize and Manago 2018; Yost and Thomas 2012). Accusations of same-sex ties between men might transcend rumor and gossip and rise to the level of scandal (Adut 2009) in heteropatriarchal societies. Thus, even though men and women might have the same capacity for sexual fluidity in terms of partner selection, same-sex ties may pose a larger threat to men by undermining their presumed heterosexuality (Mize and Manago 2018). If the prevailing norm predicates relatively less sexual fluidity for men, then this would lead to bisexual partnership histories being less frequently attributed to men compared to women. This would then transfer onto tie formation norms such that men are less frequently linked in relationships that are discordant with their existing partnership histories. The structural result of this would be the observed finding wherein men appear most frequently as either gay or straight nodes in 3- and 4-cycles.

In contrast, short cycle completion may rely on female bisexuality, especially if there are fewer bisexual men, there is an assumption that bisexual men are less common, or the plausibility of male bisexuality is lower. This pattern seemingly points to a hierarchy of invoked counter-normativity such that highly salacious same-sex ties between men are considered "off-limits" or avoided more than only moderately salacious same-sex ties between women. It may also point to a more generalized pattern wherein weaker normative expectations are "relaxed" in the presence of more salient constraints. Rumored ties might violate the relatively weaker (or at least less recognizable) constraint on short cycles while avoiding the more socially sanctionable transgression of alleging male-male ties. These co-existing prohibitions on short cycles and male-male ties could simultaneously affect rumor and gossip such that claims more frequently involve female-female links. Thus, it appears multiple normative expectations constrain network partnerships as well as rumor and gossip exchanges.

Not only do rumored ties have observable structural consequences, they can also meaningfully indicate what is considered worth discussing in the broader social network in a way that self-reported ties cannot. I distill the relationship I have conceptualized between recognizability, plausibility, and salaciousness with regard to norms of "over-closeness," "discordance," age gaps, and zodiac element incompatibility in Table 6.3.[28] The interplay between the three primary components of gossip and rumor further illustrate how and why rumored ties point to informative, valuable, and interesting discussion topics. For "over-closeness" and zodiac matching norms, there appears to be a direct trade-off between

[28] This typology allows assessing various combinations of the three components of gossip and rumor. For instance, we can categorize strong cultural taboos against cannibalism and incest in Western societies as falling into a "High" recognizability, "Low-Moderate" plausibility, "High" salaciousness configuration. Weaker or less salient cultural "rules" such as "don't wear white after Labor Day" might be categorized as having a "Moderate" recognizability, "High" plausibility, "Low" salaciousness configuration. Comparatively speaking, allegations of incest or cannibalism are too salacious to bandy about, but claims of blanched sartorial rebellion in October barely raise eyebrows.

plausibility and salaciousness wherein greater plausibility may be associated with less salaciousness and vice versa. This makes sense if we think of plausibility as akin to the "element of surprise" – inconsequential actions that presumably occur frequently are less surprising than notable deviations from how we assume most people behave. Compared to mismatched astrological signs, a notable deviation such as "over-closeness" in partnership histories makes for a much more interesting debriefing point (and thus, more interesting rumored ties).

-- TABLE 6.3 ABOUT HERE --

In contrast to the direct trade-off between plausibility and salaciousness for "over-closeness" and zodiac matching, norms regarding "discordance" in sexuality and age matching are moderated by gendered expectations. This results in variation in plausibility and salaciousness based on the gender of the individual targeted by the allegation. For example, in my findings for Analysis 3 increasing age gaps do not reliably predict rumored ties, but involvement of an older woman in age-gapped ties does. These findings support perceptions detailed in existing literature on the impact of gender in age gaps wherein older woman-younger man pairings are seen as less acceptable (Banks and Arnold 2001). Older woman-younger man couples embody the highly recognizable norm regarding age similarity, but are a less plausible occurrence than older man-younger woman. The relatively lower acceptance of older woman ties compared to older man ties makes the former a more salacious normative violation and thus a more interesting topic of discussion.

6.4 Conclusion

I began my dissertation from the premise that just as claims in gossip and rumor reveal general norms, rumored relationship ties reveal network heuristics. This is because rumored ties often deal with counter-normative actions which likewise violate expected tie formation patterns. In the WDW celebrity relationship network, these ties tend to occur as just one edge within 3- and 4-cycles and are strongly associated with short-term relationship types and the involvement of an older woman. RTDR results indicate more short cycles, more bisexual nodes, and lower network sexuality scores when rumored ties are included. Thus, rumored ties are associated with violating expectations to avoid large age gaps involving older women, "over-closeness" in short cycles, "discordance" between an individual's sexuality and the gender of selected partners, and same-sex ties in a network of primarily heterosexual nodes.

Claims exchanged within gossip and rumors must draw on norms with recognizability, have some degree of plausibility, and generate salaciousness to produce viable rumored ties. Rumored ties constructed within these exchanges also indicate which forms of counter-normativity are considered salient. Any potential regulatory function of rumored ties seemingly lies in reinforcing normative expectations. When normative violations occur it is potentially because participants are unaware of social expectations or participants are well aware and so furtively participate in them. It could also indicate that those constructing rumors and gossip are likewise unaware of the normative violations. But, it seems more likely that normative transgressions are explicitly used to heighten visibility of the violation itself. By heightening the action's visibility, rumored ties draw attention to and reinforce the normative constraints allegedly violated. For example, rumored ties may explicitly violate "over-closeness" proscriptions to elicit reactions reiterating the undesirability of short cycle formation. In doing so, rumored ties originating in gossip and rumor exchanges stigmatize and indirectly discourage further instances of these actions. If this is the case, then rumored ties have multiple implications for network structure and future tie formation, especially in populations similar to celebrities where tie formation is highly visible or closely documented. My findings might be mirrored in other networks similar to island populations with some degree of stratification between in- and out-group members, some constraint on entry into the network, and a subset of highly recognizable in-group members.

Gossip and rumors prioritize claims with recognizable counter-normativity and a reasonable degree of plausibility to enhance a tie's perceived salaciousness. In doing so, gossip and rumor actively balance the recognizability, plausibility, and salaciousness of rumored tie claims constructed and exchanged within these discourses. Including rumored ties allows observation of structural effects as well as theoretical implications reiterating their potential strategic application to achieve salaciousness. Additionally, analyzing rumored ties helps uncover negotiations in rumor and gossip as well as potential hierarchies for the norms invoked within these exchanges. Thus, rumored ties are informative as the associations I find would not be observable if the network included only self-reported relationships. Far from being "idle talk" (Foster 2004), inert statements about social entities, or meaningless chatter about celebrities, rumored ties originating in gossip and rumor exchanges actively shape network structure in observable and important ways.

6.5 Limitations and Directions for Future Research

Given the emphasis on quantitative methods, a key limitation of my dissertation is the need for qualitative explorations of my topics. Qualitative accounts of the processes for formulating and diffusing gossip and rumors would flesh out our understanding of how rumored ties come to be, especially rumored ties about romantic and sexual relationships. These investigations would help better situate rumored ties within the framework of recognizability, plausibility, and salaciousness described above in this chapter. Additionally, qualitative investigations could give a better picture of the surrounding contexts and reception of ties formed in celebrity networks. For example, interviewing Who's Dated Who contributors would lend insight into how both rumored and non-rumored ties are assessed, verified, and categorized. This would be especially informative as a way to compare how salaciousness of rumors and gossip are impacted by the recognizability of invoked norms and the plausibility of the alleged actions. Further theoretical exploration of the three components of gossip and rumor I focus on could also supplement studies of the diffusion of misinformation and disinformation in networks.

There are numerous avenues for extending the substantive topics, methods, and analytic focus of my dissertation. The substantive topics and analytic focus in my dissertation could be supplemented with comparative analyses between the WDW celebrity network and other romantic and sexual relationship networks. For instance, I did not test for the statistical significance of the celebrity network's deviations from observed age gap norms and patterns. However, future analyses could conduct t-tests of mean age gap values using available Census Bureau or American Community Survey data on marriage ties or NSFG data on relationship ties. Alternative approaches and extensions could also be applied to portions of my analysis. For instance, randomly permuting node ages and bootstrapping a distribution of random networks would supplement Analysis 3's regression models of statistically significant predictors of the number of age gaps. Additional logistic regression models could be estimated to incorporate the findings regarding larger age gaps and less age homophily among remarriage ties. Finally, my RTDR method from Analysis 1 could also be applied to different network types and other romantic and sexual relationship networks (e.g., Add Health, NSFG, etc.) to both test the method and assess whether and how targeted ties impact network structure.

The RTDR method could also be supplemented by cross-checking *z*-score results against other assessments of statistical significance such as an empirical cumulative distribution function (eCDF). Similarly, a more precise understanding of the structural constraints of targeted network edges could be achieved using Exponential Random Graph Modeling (ERGM). ERGM also has the beneficial quality of being able to control for various network characteristics such as density, homophily, and measures of network distance. The RTDR approach could also be used to examine additional structural effects by targeting tie types used in my analyses or other multiplex edges. For instance, an exploration of how age-gapped ties impact measures of connectivity and centrality (e.g., edge betweenness, node betweenness, mean harmonic centrality, etc.) and distance (e.g., mean distance, diameter, mean path length, etc.) within the largest network component.

Lastly, it would be interesting to apply my RTDR method to assess multiple vectors of multiplexity. If ties targeted for deletion were further distinguished as two subtypes, it may be possible to more precisely measure changes in network metrics. This would split multiplexity along two vectors such as rumored and age-gapped as shown in Table 6.4.

-- TABLE 6.4 ABOUT HERE --

Incorporating additional aspects of multiplexity would allow testing hypotheses about the most likely behavior of compound tie types. For example, if we know that (a) rumored ties are often involved in short cycles and (b) rumored ties are not strongly associated with or predicted by age gaps, we can contrast these points with the impact of non-rumored or age homophilous ties to hypothesize about the effect of dual non-rumored age-gapped ties. If age homophily tends to result in densely connected groups (McPherson, Smith-Lovin, and Cook 2001) which may frequently involve short cycles, but heterophily is associated with network brokerage (Burt 2004, 2005; Coleman 1988; Granovetter 1973), then we might expect age-gapped ties to occur as bridging edges linking distant network groups. Likewise, if we know (a) rumored ties frequently occur in short cycles and (b) age homophilous groups may be more likely to involve these structures, then we might again predict that non-rumored age-gapped ties are likely to have greater structural involvement in linking distant network groups. These and other explorations introducing multiple sources of multiplexity would give us a better understanding of and enhance our ability to identify networks deviating from expected tie formation patterns.

Table 6.1 Zodiac Sign and Zodiac Element for Month and Day in Date of Birth Information Subsample (76,502 Nodes and 52,714 Edges) from WDW Network [a]

		Total	
Zodiac Sign by Element:	**Birthdates:** [b]	***n*:**	**%:**
Air Signs:			
Aquarius	Jan. 20-Feb. 18	5,914	7.7
Gemini	May 21-June 21	6,356	8.3
Libra	Sept. 23-Oct. 23	6,101	8.0
Subtotal	**-**	***18,371***	***24.0***
Earth Signs:			
Taurus	Apr. 20-May 20	6,097	8.0
Virgo	Aug. 23-Sept. 22	6,224	8.1
Capricorn	Dec. 22-Jan. 19	5,775	7.6
Subtotal	**-**	***18,089***	***23.7***
Fire Signs:			
Aries	Mar. 21-Apr. 19	5,959	7.8
Leo	July 23-Aug. 22	6,095	8.0
Sagittarius	Nov. 22-Dec. 21	10,138	13.3
Subtotal	**-**	***22,192***	***29.0***
Water Signs:			
Pisces	Feb. 19-Mar. 20	6,143	8.0
Cancer	June 22-July 22	6,156	8.1
Scorpio	Oct. 24-Nov. 21	5,551	7.3
Subtotal	**-**	***17,850***	***23.3***
Total Obs:	**-**	**76,502**	**100.0**

Note: a Percent totals may not sum to 100.0% due to rounding error.

b Birthdate ranges according to Britannica 2023; minor variation in zodiac start and end dates may exist depending on source used.

Table 6.2 Observed Network Values for Month and Day in Date of Birth Information Subsample vs. Test Statistics for Random Tie Deletion Networks (1,000 Iterations; Two-tailed Significance Tests)

Edge Characteristic:	**Observed %:** [a]	**Rumored Tie Deletion** *Point Estimate %*:	**Random Tie Deletion** *Mean %*:	*z*:		*SE*:
Zodiac Element Incompatibility	49.6	50.2	50.0	-0.97		0.00
No Age Gap	6.7	5.2	5.3	-2.73	**	0.00
Age Gap of 1-5 Yrs	44.5	42.5	42.6	-1.62		0.00
Age Gap of 6-10 Yrs	22.6	24.9	24.9	0.14		0.00
Age Gap of 11-15 Yrs	11.9	14.2	14.1	1.55		0.00
Age Gap of ≥16 Yrs	14.2	16.0	16.0	0.09		0.00

Note: a Observed network values include 3,848 Rumored ties. Random tie deletion networks remove *n*=3,848 edges at random. Percent totals may not sum to 100.0% due to rounding error.

* Significant at 0.01-level.

** Significant at 0.001-level.

*** Significant at 0.000-level.

Table 6.3 Categorizing Normative Expectations, Normative Violations, Network Heuristics, and Structural Effects of Violations based on the Three Components of Gossip and Rumor

Normative		**Network/Structural**		**Component of Gossip and Rumor** [a]		
Expectation:	**Violation:**	**Heuristic:**	**Effect of Violation:**	**Recognizability:**	**Plausibility:**	**Salaciousness:** [b]
Don't Date Your Ex's Ex or the Ex of Your Ex's Ex	"Over-Closeness"	Acyclicity	More Short Cycles	Moderate	Moderate	Moderate-High
Consistent Sexuality	"Discordance"	No "Mixed" Tie Formation Histories	More Bisexual Nodes	High	Low (for Men); Moderate (for Women)	High (for Men); Moderate (for Women)
Partners within 3-4 Yrs of Each Other's Age	Age Gaps ≥10 Yrs	Age Homophily	Less Age Assortativity	High	Low (for Older Women); High (for Older Men)	High (for Older Women); Low-Moderate (for Older Men)
Air Signs pair with Fire Signs, Earth Signs pair with Water Signs	Zodiac Element Incompatibility	Zodiac Element Homophily	Less Assortativity	Low	High	Low

Note: a Assessments of components of gossip and rumor may change over time.

b Assessments of salaciousness may depend on the individual-level heuristics/patterns of behavior for the target(s) of gossip and rumor.

Table 6.4 Two Sources of Multiplexity for a Subset of "Special" Ties Based on Rumored and Age-gapped Status

		Second Source of Multiplexity	
		Age-gapped:	
First Source of Multiplexity	***Rumored:***	(a) Yes, Yes	(b) No, Yes
		(c) Yes, No	(d) No, No

APPENDICES

1.1 Appendix A – Notes on Data Source (whosdatedwho.com, WDW)

1.1.1 Date of Creation

The site's relatively recent creation may mean there is some recency bias such that included profiles disproportionately highlight celebrities who are either currently well-known or have had a consistent public presence since at least the 1950s. If recency bias does affect which celebrities are included on the site, then profiles of currently or more recently famous individuals may attract more attention and thus more complete or accurate relationship histories. In contrast, profiles for older celebrities may garner lower overall interest and thus lower relationship history completion or accuracy rates. Additionally, older or deceased celebrities may not generate enough interest to merit contemporaneous discussions about them, which could artificially decrease the number of rumored ties attached to them. The implication of skewed interest due to recency bias is that there may be some artificially increased accumulative advantage affecting the chances of attracting rumored relationships for a subset of profiles.

1.1.2 Editing Structure

The site has a hierarchical editing structure with the following levels: "Site Director," "Chief Editor," "Super Star Editor," "Star Editor," "Editor," "Fan" (users with a registered account), and unregistered users (logged via IP address). "Star Editors," "Super Star Editors," and "Chief Editors" appear to be registered users who consistently contribute accurate, verifiable, or approved edits and information. Users move between levels by earning points associated with contributing content to the website (approximately 200, 5,000, 20,000, and 500,000 points for "Editor," "Star Editor," "Super Star Editor," and "Chief Editor" status, respectively). As an additional incentive, users can earn profile badges for notable accomplishments such as being a long-term member of the site, being a top-ranking editor in a given year, or contributing "trustworthy" content. All levels in the editing hierarchy can submit suggestions for edits to individual profiles, but only users at or above the level of "Star Editor" can comment on suggested edits to note whether and why the suggestions should be accepted or rejected. Additionally, only approved moderators, "Chief Editors," and "Site Directors" can update profiles by screening suggested edits and marking submissions for rejection or acceptance on the site. Users at the highest levels of the hierarchy can also block accounts from contributing to the site.

1.1.3 The Nature of the Celebrity Dating Market

Although non-famous people are included on WDW, it is reasonable to ask whether the celebrity world functions as a closed relationship market wherein celebrities are primarily interested in dating other celebrities. Romantic interest may be amplified by celebrity status, but reduced or negatively impacted for those in more highly stigmatized (albeit equally public) industries, such as sex work and pornography (Matos and Haze 2019). To some degree, there is obvious status homophily in celebrity relationships (e.g., singer Beyoncé and rapper Jay-Z are both internationally famous music artists). However, there are numerous instances wherein someone famous dates or marries someone who is less well known by the general public (e.g., tennis player Serena Williams and Reddit co-founder Alexis Ohanian). There are also instances wherein a completely unknown person increases their notability and thus their access to the celebrity dating market by associating with someone more established. In some cases, formerly unknown people become celebrities in their own right and eclipse the fame of their initial partner (e.g., reality TV star Kim Kardashian, who was unknown before her 2003 relationship with R&B singer Ray J). However, this pathway does not necessarily confer celebrity status if the non-famous party remains out of the public eye or does not actively pursue stardom. The many instances of celebrity-celebrity, celebrity-less famous person, and celebrity-unknown person relationship types in the WDW dataset would seem to indicate that this dating market is not completely closed.

2.1 Appendix B – Gender Coding

2.1.1 Excluded Cases with Un-codable or Missing Data on Gender

Cases with un-codable or missing data on gender have profiles with anonymized names or pseudonyms and no additional characteristics allowing verification of identities (see Appendix Table 2.1). One of these cases ("un-named") seems to be the collected dating histories of multiple individuals who presumably did not publicly identify their relationship partner by name. The other three cases are instances of pseudonyms or anonymized profile names ("cuntface," "dating-102117068," and "single-parent"). Some portions of the coding algorithm described in later sections of Appendix 2.1 classified "cuntface" and "un-named" using assumptions about name phonemes and spellings (i.e., names ending in "-e" are feminine, names ending in "-d" are masculine). However, these cases were still excluded because no other names or characteristics indicating gender were listed on the profiles.

-- APPENDIX TABLE 2.1 ABOUT HERE --

2.1.2 Initial Coding of Gender Based on Profile Pronouns and Names

No profile field explicitly indicates sex or gender on whosdatedwho.com (WDW). I instead rely on several pieces of information to code gender. The first piece of information is the pronoun listed in an individual's profile header (e.g., "Who is *she* dating right now?," emphasis mine), which I allow to take initial precedence. I then assess whether the listed pronoun matches the estimated gender for other indicators included on an individual's profile.

I first assess the accuracy of listed pronouns based on whether these match the estimated gender of any listed first name and given first name at birth. To test the accuracy of listed pronouns among those whose nationality was listed as "American," I estimate the gender of the listed first name and given first name at birth (if available) using U.S. Social Security

Administration birth registration records for 1880-2011 (100% samples; US SSA 2021). The relative proportions of male and female babies born with one of the 1,000 most popular baby names are estimated for each year. Names with a proportion of 0.51 or greater for either gender are considered "likely male" or "likely female." Names with an equal proportion of male and female babies are considered "likely androgynous." Gender proportions from 1880 and 2011 are used for individuals with a listed year of birth before 1880 or after 2011, respectively. Only names with more than three words in the listed full name at birth are considered to have both a given first and given middle name. If a name is not found for the listed year of birth, gender proportions for 1990 are used. If a profile name is not found in the U.S. Social Security Administration data at all, it is estimated using the protocol for "non-American" nationalities described below. If the name is still not found, the estimate is considered missing data.

For example, the entry for American-born media personality Amber Rose has "1983" as the listed year of birth and "Amber Levonchuck" as the listed full name at birth (see Appendix Table 2.2). The profile first name ("Amber") matches the given first name at birth, so only the listed first name required a gender estimate. The proportion of American babies born in 1983 named "Amber" is 0.997 female and 0.003 male. Thus, I consider the estimated gender of the name "Amber" to be "likely female" for those born in 1983. Cases are considered "concordant" if the listed pronoun matches the estimated gender of the listed first and given first name. For Amber Rose, the listed pronoun is "she" and the estimated name gender is "female;" thus, I consider this profile information to be concordant. Cases are flagged as "discordant" if the gender of the pronoun does not match the estimated gender of the listed first name and given first name.

-- APPENDIX TABLE 2.2 ABOUT HERE --

For non-American nationalities, I estimate the gender of the listed first name and given first name at birth (if available) using a dictionary of international names from more than 58 countries (Michael 2008; see nam_dict.txt 1.2 file). I estimate the relative frequency of men and women with a specific name and then assume the gender with the highest frequency is the most likely name gender. Names with an equal frequency of men and women with that name or that are indicated as "unisex" are considered "likely androgynous." Again, as with American names, I consider the estimate to be missing data if a name is not found.

As an example, the entry for Canadian-born rapper Drake has "1986" as the listed year of birth and "Aubery Drake Graham" as the listed full name at birth (see Appendix Table 2.2).[29] The profile first name ("Drake") does not match the given first name at birth ("Aubery"), but does match the given middle name. According to the international name-gender dictionary, "Drake" is most frequently a male name, but "Aubery" is not found. Thus, I would estimate the gender of the name "Drake" as "likely male," but would consider "Aubery" as missing data for coding gender. For Drake, the listed pronoun is "he" and the estimated gender for his first name is "likely male" (which would be concordant on gender). The listed pronoun does not match the estimated gender of his given first name at birth ("Aubery"), which is not listed in the international names dictionary. I thus consider this profile information to be discordant on gender due to the mismatch between the listed pronoun and the gender estimate for the given first name at birth.

I flag the following cases for additional assessment: discordant cases, cases with missing name gender estimates, and cases with "they" as the listed profile pronoun.

[29] It should be noted that "Aubery" is a misspelling of Drake's given first name ("Aubrey"). Using multiple indicators for gender is beneficial in cases involving misspellings or other data entry issues. The typo has since been corrected on Drake's WDW profile.

2.1.3 Secondary Coding of Gender for "They" Pronouns, Discordant Cases, and Cases with Missing Name-Gender Estimates

Profiles listing a "they" pronoun could reflect substantive non-binary gender identities or missing data. In the initially scraped dataset, 5,066 unique profiles list a "they" pronoun, so to fill in this missing data, I infer gender pronouns for these profiles. I give initial precedence to and assume pronoun gender matches name-gender estimates if the listed first and given first names (if available) have valid and concordant estimates. For those without a listed given first name, the gender of pronouns is assumed to match the gender of the listed first name if the listed first name has a valid estimate. Secondary coding for "they" pronouns reduces the initial 5,066 cases to 570 cases. I hand-coded a random sample of the 570 remaining cases (*n*=171) to verify the presence of substantive non-binary identities, but found no such profiles. I thus interpret "they" pronouns as missing data. It is worth noting that I scraped the data between July 2019-October 2020, which is slightly before widespread shifts toward acknowledging non-binary identities using "they/them/their" pronouns. According to Google Trends data on search term popularity, searches for "non-binary" and "they them pronouns" peaked in mid-May and mid-June 2021 (see Appendix Figure 2.1 and Appendix Figure 2.2; Google Trends 2022a, 2022b).

-- APPENDIX FIGURE 2.1 ABOUT HERE --

-- APPENDIX FIGURE 2.2 ABOUT HERE --

For all cases needing secondary coding of gender due to discordant or missing profile information, I assess the listed profile first names to see if these are an exact match with the given first or given middle name at birth (if available). This step flags cases for gender discordance potentially due to the use of stage names, transgender people who adopted gender-affirming names, or data entry errors. Similarly, I check the listed profile first names to see if these are diminutives of the given first or given middle name at birth (if available). Here, I flag cases for gender discordance potentially due to the use of diminutives or shortened names primarily associated with the opposite gender (e.g., "Samantha" is a female name, but is sometimes shortened to "Sam" which is a male name).

For the next step in coding discordant cases, cases with missing name estimates, and cases with "they" as the listed profile pronoun, I create a multivariate indicator of "likely gender" using:

1. Gender indicators from profile blurbs (if available). For example, instances of the words "she," "hers," "female," "women('s)," etc. or "he," "his," "male," "men('s)," etc. are counted. The word group with the highest number of appearances in profile blurbs is used as the gender estimate for this indicator. If no keywords are found, the estimate is considered missing data;
2. Secondary estimations of the gender of names using the U.S. Social Security Administration data for cases with a "non-American" nationality whose names are not found in the international name-gender dictionary. If the names are also not found in the U.S. Social Security Administration data, the estimate is considered missing data;
3. Assessments of listed profile first name and full name at birth (if available) for generational suffixes (e.g., "Jr.," "Sr.," "II," etc.). Cases with this information are estimated as "male" for this indicator. Cases without this information are considered missing data;
4. Gender indicators from name spellings and phonemes. For those whose listed nationality is "American," names ending in "a," "i," "ly," "th," "ley," "lyn," or "vyn" are estimated

as “female” for this indicator. Names ending in “d,” “o,” “z,” “on,” “ry,” or “el” are estimated as “male” for this indicator. For those not listed as “American,” names ending in “a” or “i” are estimated as “female” for this indicator. Names ending in “d,” “o,” “u,” “y,” or “z” are estimated as “male” for this indicator; and

5. Gender indicators from biometric information (if available). Cases are estimated as “female” for this indicator if this information includes bust measurements (bra cup or band size) or a listed height less than 5’3” (160 cm). Cases are estimated as “male” for this indicator if this information includes a listed height greater than 6’3” (190 cm)

I construct a “likely gender” estimate based on the number of gender indicators found. Profiles with more information obviously provide better chances for accurately estimating gender. As such, I use and prioritize indicators based on explicit (e.g., name suffixes, profile blurb, biometrics) and inferred information (e.g., name gender, name gender based on phonemes and spelling) to address variation in profile completeness. For those with a listed full name at birth, the likely gender is assumed to match the majority of gender indicators if and only if the profile blurb, biometric information, and given first name gender do not indicate the opposite gender. Thus, if mostly “female” indicators are found, I assume the “likely gender” is “female” only if this is not contradicted by the profile blurb, biometrics, or given first name gender estimates. This is done to give more weight to potentially more accurate gender indicators.

For those without a listed full name at birth, I assume the “likely gender” matches the majority of gender indicators if and only if the profile blurb and biometric information do not indicate the opposite gender. Thus, if mostly “male” indicators are found, the “likely gender” is assumed to be “male” only if the profile blurb and biometrics do not indicate “female.” If the number of indicators is equal for both genders, the “likely gender” estimate is considered “inconclusive.” If no additional gender indicators are found, the “likely gender” is considered missing data. I then re-classify cases for discordance between listed profile pronouns and “likely gender” estimates.

We can return to our previous example cases to illustrate this step. Drake is already classified as “he” based on initial coding stages which makes secondary coding unnecessary. However, if secondary coding for Drake were needed, the “likely gender” estimate would be “male” based on three of the five key indicators being “male,” no indicators being “female,” two being “none” due to missing data, and no indicators being “inconclusive” due to having an equal number of male and female gender estimates (see Appendix Table 2.3). Similarly, if secondary coding were required for Amber Rose, the “likely gender” estimate would be “female” based on two of the five key indicators being “female,” no indicators being “male,” three being “none” due to missing data, and no indicators being “inconclusive” due to having an equal number of male and female gender estimates (see Appendix Table 2.3).

-- APPENDIX TABLE 2.3 ABOUT HERE --

2.1.4 Tertiary Coding of Gender for “They” Pronouns

As stated in Appendix 2.1.3, it appears “they” pronouns are missing data rather than substantive non-binary identities. Out of 111,441 total unique profiles scraped from WDW, the initial 5,066 cases with “they” pronouns were reduced to 570 cases during secondary coding. To fill in the remaining missing data, I give initial precedence to and assume pronoun gender matches name-gender estimates if the listed first and given first names (if available) have valid and concordant estimates that are not discordant with the “likely gender” estimator. For those without a listed given first name, the gender of pronouns is assumed to match the gender of the listed first name if the listed first name has a valid estimate and is not discordant with the "likely gender" estimator. I flag cases with "androgynous" or missing name-gender estimates for further evaluation.

Tertiary coding of "they" pronouns further reduces the 570 cases to 44 cases which I then code by hand. I hand-coded an additional 38 cases initially listed with "they" pronouns which have either discordant information within the "likely gender" estimators or discordant information between these values and the name-gender estimates. Lastly, I hand-coded 10 cases with "inconclusive" estimates and 6 cases with no inferred pronoun based on name-gender estimates.

2.1.5 Tertiary Coding of Gender for Cases with Missing Name-Gender Estimates

I classify cases initially missing name-gender estimates for discordance between listed profile pronouns and valid "likely gender" estimates. If the listed pronoun matches the "likely gender" estimator, the pronoun is given precedence and assumed to be accurate. This reduces 10,940 missing name estimate cases to 2,401 cases. I allow the gender of the remaining missing name estimate cases to default to the listed profile pronoun if the profile blurb or biometric estimates do not contradict it. This reduces 2,401 cases to 21 cases which were then coded by hand.

2.1.6 Tertiary Coding of Gender for Discordant Cases

I again re-classify cases for discordance between listed profile pronouns and the "likely gender" estimator. This results in 7,819 discordant cases and an additional 846 cases flagged as discordant after the tertiary coding of "they" pronouns and cases with missing name-gender estimates. For the remaining discordant cases, listed profile pronouns are given precedence if these are not contradicted by the profile blurb or biometric estimates. Additionally, listed profile pronouns are given precedence in cases where the "likely gender" estimator is based only on the gender of name phonemes. I hand-coded 79 remaining discordant cases and 28 remaining discordant cases with missing name-gender estimates.

Based on a random sample of 400 observations, I found no instances of incorrect pronouns as listed on WDW profiles. Thus, I assume the error rate is reasonably low when using listed profile pronouns to indicate gender. Additionally, the large overall sample size makes the network measures fairly robust to potential errors in the coding of gender pronouns.

2.1.7 Secondary Coding of Gender for Transgender People

I also checked the sample to identify transgender people (41 unique nodes with 65 unique ties). I start by comparing profiles in the WDW dataset to multiple repositories or lists of notable transgender people. This allows me to assess the accuracy of algorithms used to flag potentially transgender cases based on listed profile information. Some profiles are missed if gender indicators match the listed profile pronoun while others are flagged due to discordant gender indicators. For instance, the WDW profile for Caitlyn Jenner has "Caitlyn" as the listed first name and masculine names in the listed full name at birth. The name-gender estimates would thus be "likely female" for the listed first name, but "likely male" for names in the listed full name at birth. The names in Jenner's full name at birth and the listed profile pronoun are thus discordant with the name-gender estimate for her listed first name. Even if Jenner were not identified due to appearing in lists of prominent transgender people, these pieces of information would flag her profile as a possible case of discordance.[30]

[30] Similar to the coding of other discordant cases or cases with missing name-gender estimates and given transgender people make up only 0.05% of the initially scraped sample, listed profile pronouns (if available) are allowed to take precedence.

A few things should be noted for the coding schema of transgender people. First, profile discordance is likely evidence of variation in the timing of transition relative to network entry. For instance, like Caitlyn Jenner, those who transition after initially receiving a WDW profile may be more likely to have discordant gender indicators relative to those who transitioned before their profile was made. As a result of this pattern, the former group may be more likely to be flagged as "possibly transgender." Second, notability may play a role such that more well-known individuals have more complete profiles providing more indicators of the discordance used to flag and verify transgender cases. Third, the gender coding of transgender people has implications for estimating the behavioral sexuality of their partners. For example, Caitlyn Jenner's marriage to Kardashian-Jenner Momager Kris Jenner occurred before Caitlyn's transition (Siwak 2022). Kris Jenner likely would not have seen herself as having been in a same-gender relationship during their marriage despite a later change in Caitlyn's gender identification. This phenomenon of gender coding impacting partners' behavioral sexuality estimates would also be present for non-transgender people with errors in listed profile pronouns. Thus, coding and verification of any gender-discordant cases and potentially transgender people was a necessary step to maximize the reliability and accuracy of node sexuality as a key parameter of interest.

2.1.8 Comparison of My Algorithm Versus Other Databases for Coding Gender of Names

I further assess the accuracy and reliability of my approach by briefly comparing results from my algorithm for coding gender of names to those available on the web service Genderize. Estimates on the Genderize site appear to be reasonably accurate with a few notable caveats. First, the estimates may be more heavily weighted toward countries with the bulk of observations. The top ten countries (France, Italy, Spain, Turkey, Germany, Poland, United

Kingdom, Russia, Czech Republic, and Portugal, *n*=72,167,926 out of 114,541,298 total observations in October 2023) make up 63% of the Genderize dataset. This is fine if your analysis is focused on these countries or countries with similar naming conventions, but may result in less accurate estimates or missing data for other locations.

Second, Genderize does not appear to be able to account for diminutives of full names. A common type of gender discordant case in the WDW dataset was for discordance between gender of a listed name which was a shortened version of the first name at birth. For example, “Samantha” is a female name (Genderize results: “{"count": 335370, "name": "samantha", "gender": "female", "probability": 1.0}”), but its diminutive “Sam” is a male name (Genderize results: “{"count": 447613, "name": "sam", "gender": "male", "probability": 0.96}”). However, there’d be no way to reconcile this discrepancy if we used only one set of names to estimate using Genderize.

Lastly, Genderize may not be able to account for variation by year of birth, which means it also may not be able to fully account for change over time. In the U.S., the name “Robin” was previously a male name, but sometime around 1940 it shifted to being a primarily female name (see Appendix Figure 2.3 generated using U.S. Social Security Administration data; US SSA 2021). Genderize estimates that “Robin” is a male name (Genderize results: “{"count": 44438, "name": "robin", "gender": "male", "probability": 0.76}”), but using this estimate would mean women named Robin born during or after 1940 would be incorrectly labeled as male (see Appendix Figure 2.3). The issues of diminutives and variation by year of birth are two of many factors reiterating the need for the more nuanced gender estimator used in my analysis.

-- APPENDIX FIGURE 2.3 ABOUT HERE --

Appendix Table 2.1 Subset of Observations with Un-codable or Missing Data on Gender

Ego:	**Alter:**	**Ego Pronoun:**	**Alter Pronoun:**	**Rumored Tie:**
cuntface	dan-the-song-parody-man	They	He	No
cuntface	jeff-the-drunk	They	He	No
dating-102117068	carolina-moran	They	She	No
single-parent	sharon-morgan	They	She	No
un-named	allan-kerr-taylor	They	He	No
un-named	billie-buckwheat-thomas	They	He	No
un-named	christina-reid	They	She	No
un-named	denis-mitchison	They	He	No
un-named	ethel-teare	They	She	No

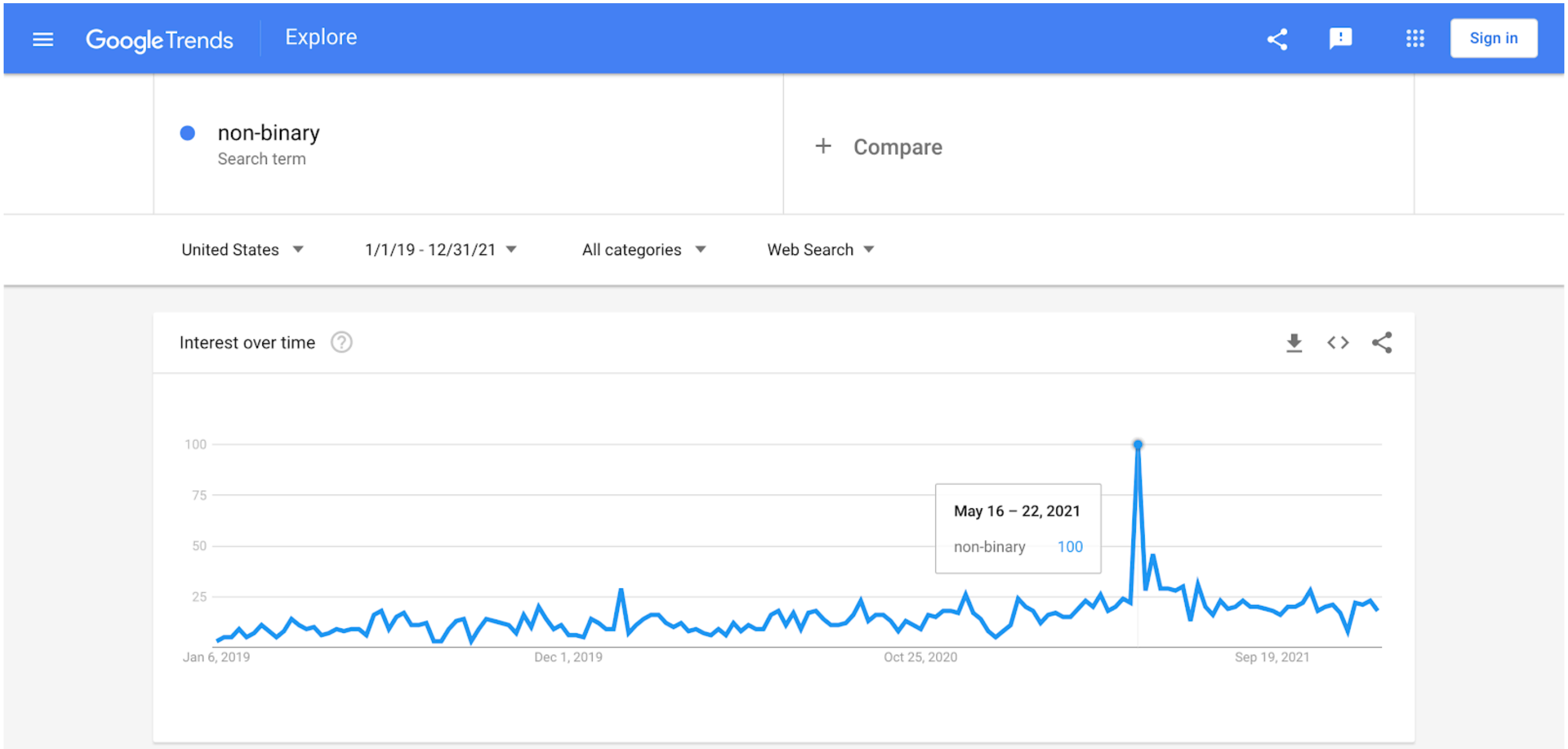
Appendix Table 2.2 WDW Profile Information for Initial Coding of the Gender of Names for Amber Rose and Drake [a]

	For	
Profile Information:	***Amber Rose*:**	***Drake*:**
Nationality	American	Canadian
Birthday	October 21, 1983	October 24, 1986
Listed Profile Name	Amber	Drake
Full Name at Birth [b]	Amber Levonchuck	Aubery Drake Graham
Listed Pronoun	She	He
First Name	Amber	Drake
First Name Gender (US)	Female	Male
First Name Proportion Female (US)	0.997	0.000
First Name Proportion Male (US)	0.003	1.000
Given First Name [b]	Amber	Aubery
Given First Name Gender (US)	Female	None
Given First Name Proportion Female (US)	0.997	None
Given First Name Proportion Male (US)	0.003	None
Given Middle Name	N/A	Drake
Given Middle Name Gender (US)	N/A	Male
Given Middle Name Proportion Female (US)	N/A	0.000
Given Middle Name Proportion Male (US)	N/A	1.000
First Name Gender (International)	Female	Male
Given First Name Gender (International)	Female	None
Given Middle Name Gender (International)	N/A	Male
Name Mismatch	None	First-Given Name

Note: a U.S. name estimates based on U.S. Social Security Administration birth registration records for 1880-2011 (100% samples; US SSA 2021), international estimates based on dictionary of international names from more than 58 countries (Michael 2008; see nam_dict.txt 1.2 file).

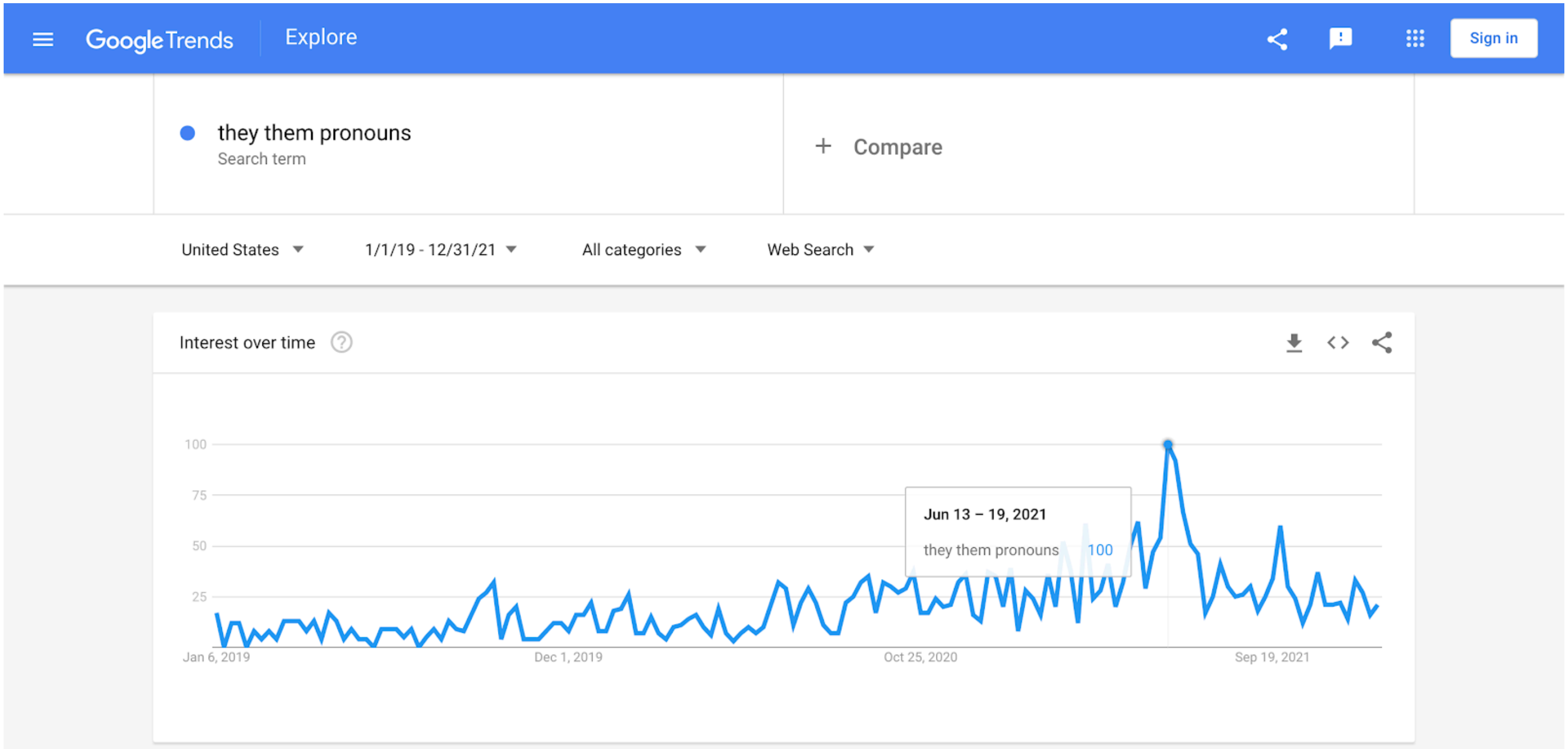
b Information as of 7/2019-10/2020. As of February 16, 2022, Amber Rose's profile has since been updated to list "Amber Rose Levonchuck" as the full name at birth and Drake's profile has since been updated to correct the typo in the given first name at birth ("Aubrey").

Appendix Figure 2.1 Google Trends Results for "Non-Binary" [a]



Note: a Results for the period between 1/1/2019-12/31/2021. Google Trends search results for "non-binary" peaked between May 16-22, 2021.

Appendix Figure 2.2 Google Trends Results for "They Them Pronouns" [a]



Note: a Results for the period between 1/1/2019-12/31/2021. Google Trends search results for "they them pronouns" peaked between June 13-19, 2021.

Appendix Table 2.3 WDW Profile Information for Secondary Coding of the Gender of Names for Amber Rose and Drake [a]

Profile Information and Estimate:	**For** ***Amber Rose*****:**	***Drake*****:**
Nationality	American	Canadian
Listed Profile Name	Amber	Drake
Full Name at Birth [b]	Amber Levonchuck	Aubery Drake Graham
Listed Pronoun	She	He
First Name	Amber	Drake
Given First Name [b]	Amber	Aubery
Given Middle Name	N/A	Drake
First Name Proportion Female (US)	0.997	0.000
First Name Proportion Male (US)	0.003	1.000
First Name Gender Estimate	**Female**	**Male**
Secondary First Name Gender Estimate [c]	N/A	Male
Diminutive Name(s)	None	None
Generational Name Suffix	None	None
Generational Name Suffix Estimate	**None**	**None**
First Name Phoneme	-r	-e
Given First Name Phoneme	-r	-y
Given Middle Name Phoneme	N/A	-e
Name Phoneme Estimate	**None**	**Male**
Profile Blurb	No indicators found	businessman, he, his, He
Profile Blurb Estimate	**None**	**Male**
Height [d]	5’8 ½” (174 cm)	6’0” (183 cm)
Bra (Band) Size	36	N/A
Cup Size	H	N/A
Biometrics Estimate	**Female**	**None**

Appendix Table 2.3 WDW Profile Information for Secondary Coding of the Gender of Names for Amber Rose and Drake [a] (continued)

Profile Information and Estimate:	For *Amber Rose*:	*Drake*:
Number of "Female" Indicators	2	0
Number of "Male" Indicators	0	3
Number of "None" Indicators	3	2
Number of "Inconclusive" Indicators	0	0
Likely Gender Estimate	**She?**	**He?**

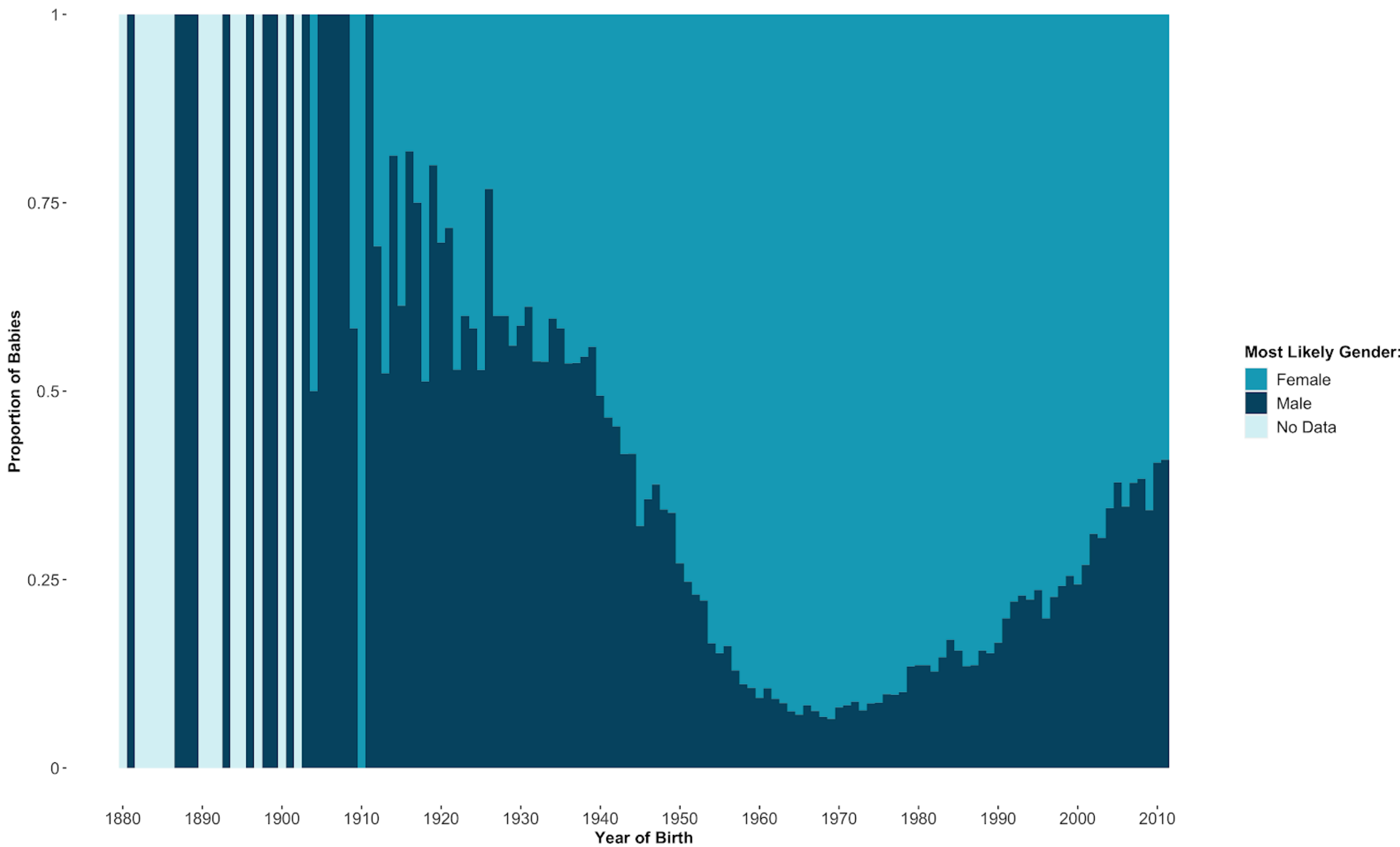
Note: a U.S. name estimates based on U.S. Social Security Administration birth registration records for 1880-2011 (100% samples; US SSA 2021), international estimates based on dictionary of international names from more than 58 countries (Michael 2008; see nam_dict.txt 1.2 file).

b Profile information as of 7/2019-10/2020. As of February 16, 2022, Amber Rose's profile has since been updated to list "Amber Rose Levonchuck" as the full name at birth and Drake's profile has since been updated to correct the typo in the given first name at birth ("Aubrey").

c Secondary first name gender estimates based on U.S. Social Security Administration birth registration records for 1880-2011 (100% samples; US SSA 2021), used for cases with a non-American nationality whose names are not found in the international name-gender dictionary (Michael 2008; see nam_dict.txt 1.2 file).

d Profile information as of 7/2019-10/2020. As of February 16, 2022, Drake's profile has since been updated to list 5'11 ¾" (182 cm) for height.

Appendix Figure 2.3 Most Likely Gender for American Babies Named "Robin" by Year of Birth (1880-2011) [a]



Note: a Proportions based on U.S. Social Security Administration Birth Registration Data (US SSA 2021); equal proportions of female and male babies named "Robin" in 1904.

3.1 Appendix C – Exclusion of the Adult Film Industry from the Dataset

Insofar as it produces content based on consumer demand and preferences, on-screen relationships in pornography may have systematically different tie formation heuristics than do conventional romantic and sexual relationship networks (Berg 2021:66-67,81). Two popular content categories ("lesbian" and "threesome") in pornography are directly relevant to the formation of 3-cycles and both sexuality hypotheses. In 2019, the pornography website Pornhub received 42 billion visits and had over 39 billion searches performed (Pornhub Insights 2019). "Lesbian" was the most popular search term and the #1 video category from 2007-2016 among all users worldwide (Pornhub Insights 2017a). This category has consistently ranked in the top 3 search terms among all users worldwide and in the top 4 for U.S.-based user search terms between 2014-2021 (Pornhub Insights 2015, 2016, 2017b, 2018a, 2018b, 2019, 2021). It was the #1 category among all users worldwide in 2015-2018 and among U.S. users from 2015-2019 (Pornhub Insights 2015, 2016, 2017b, 2018a, 2018b, 2019, 2021). The lowest the "lesbian" porn category has ranked was #2 in 2019 and 2021 for all users worldwide and #2 in 2021 for U.S. users (Pornhub Insights 2015, 2016, 2017b, 2018a, 2018b, 2019, 2021).

"Threesome" has consistently ranked in the top 15 for search terms among all users worldwide and in the top 12 for U.S.-based user search terms between 2014-2021 (Pornhub Insights 2015, 2016, 2017b, 2018a, 2018b, 2019, 2021). This category usually ranks in the top 12 and top 10 among all users worldwide and U.S. users, respectively (Pornhub Insights 2015, 2016, 2017b, 2018a, 2018b, 2019, 2021). Although less popular than the "lesbian" search term and category, "threesome" ranked as highly as the #3 search term and #4 category among U.S. users during 2018 (Pornhub Insights 2018b). Among all worldwide users, it has ranked as highly as #11 in 2014 and #8 in 2018 for search terms and categories (Pornhub Insights 2015, 2018b).

The popularity of content depicting same-sex female ties and group sex involving three individuals would be associated with a relatively greater number of 3-cycles (Hypothesis 1), a relatively higher number of bisexual nodes (Hypothesis 3), and a relatively lower sexuality score for the overall network (Hypothesis 4). Moreover, the nature of pornography as an industry would also have implications for short cycle formation (Hypotheses 1 and 2). Firstly, occupational boundaries around the adult film industry would exacerbate performers' similarity to subgroups in network cores. In a network core, a subset of individuals from the overall population form relationship ties within a relatively restricted and overlapping pool of partners. This results in a greater likelihood of short cycle formation compared to that in non-network core subgroups (Bearman et al 2004:48,50). Here, the individual adult film performers make up the subgroup, other performers make up the restricted pool of partners, and ties formed during co-starring appearances would create overlapping relationship histories contributing to network cycles. Any social segregation (whether of celebrities in general or adult film workers specifically) may encourage short cycle formation. Celebrities are cordoned off from the general public to some degree, but there may be fewer factors imposing this separation. Factors separating dating pools of celebrities from completely unknown individuals may be weaker than those separating unknown individuals and porn stars. It is also possible that romantic interest is amplified by celebrity status, but reduced or negatively impacted for those in highly stigmatized sex work industries, particularly women (Matos and Haze 2019).

A network containing only individuals employed in the adult film industry should have a lower value for overall sexuality (i.e., nodes in the network should be *less* straight), more female bisexuals, and higher average degree (k_i). Indeed, as per Appendix Table 3.1, I find exactly this among adult film industry workers listed on WDW.

-- APPENDIX TABLE 3.1 ABOUT HERE --

The mean sexuality score for *n*=1,065 nodes in dyads where both individuals are employed in the adult film industry is equal to 0.41 (see Appendix Table 3.1). Thus, the average node is closer to being behaviorally bisexual than behaviorally gay, lesbian, or straight. This value is lower among women compared to men (0.20 and 0.93 for women and men, respectively). In this subsample, 30.2% of women are behaviorally bisexual versus approximately 1.0% of men (exact percentage equal to 0.96%). Nodes have on average 3.82 network ties (median degree equal to 2, maximum degree equal to 108). When comparing sexuality scores for men, the WDW network's average is lower than that of the adult film industry. This potentially reiterates observations regarding the separation of female performers from gay male performers based on performance histories (Schieber 2018; Thomas 2010; Weitzer 2010).

The vast majority of nodes are women (70.5% women versus 29.5% men; see Appendix Table 3.2), which likely lowers the overall mean sexuality score if women are more likely to have formed ties with both sexes. Moreover, median sexuality scores reiterate this dynamic with adult film industry women as the only group with a median value of less than 1.00 (see Appendix Table 3.1). This subsample may not be representative of the adult film industry at large if there is selection bias for receiving a WDW profile. This bias may be a function of a performer's fame, the salience of tie formation history due to bisexuality or high degree, or fan interest. The latter factor may also interact with gender such that female performers may receive more fan interest than their male co-stars. However, this effect is likely similar to that seen in the network of valid observations included in the analysis.

-- APPENDIX TABLE 3.2 ABOUT HERE --

There are 442 3-cycles and 8,155 4-cycles involving 726 nodes and 1,743 edges in the adult film industry subsample. Although the sample was screened for duplicate profiles, these values may include instances of döppelgangers wherein an individual is in a short cycle with themself. However, döppleganger cases are likely low enough that similar numbers of short cycles would result even after their removal.

Not surprisingly, given that most tie formation is documented in some way for the adult film industry subsample, there is a much lower proportion of rumored ties (0.64% or n=13 rumored ties out of 2,033 total edges versus 4.3% or n=3,848 rumored ties out of 88,746 total edges in the full sample). The subsample of only adult film industry performers has more "bisexual" women, a higher mean degree (k_i), and a higher proportion of nodes and edges involved in short cycles compared to the sample excluding these individuals. For these reasons, I exclude individuals whose profiles note adult film industry employment to avoid measuring on-screen sex ties. Removing those employed in the adult film industry admittedly has the downside of removing performers' off-set relationships (e.g., Stormy Daniels' relationship with former President Donald Trump), but it may reduce artificial inflation of key measures of interest.

Appendix Table 3.1 Descriptive Network Statistics by Node Gender for WDW Network (109,626 Nodes and 88,746 Edges) and Adult Film Industry Network (1,065 Nodes and 2,033 Edges) [a]

	WDW Network			Adult Film Industry Network		
Network Statistic:	***Men*:**	***Women*:**	***Total*:**	***Men*:**	***Women*:**	***Total*:**
Bisexual Nodes: [b]						
n	909	1,036	1,945	3	227	230
%	1.7%	1.9%	1.8%	1.0%	30.2%	21.6%
Nodes with Rumored Ties:						
n	2,187	2,337	4,524	6	28	34
%	4.0%	4.2%	4.1%	1.9%	3.7%	3.2%
Total Nodes:						
n	54,157	55,469	109,626	314	751	1,065
% of	49.4%	50.6%	100.0%	29.5%	70.5%	100.0%
Node Degree:						
Mean	1.64	1.59	1.62	4.73	3.44	3.82
Median	1.00	1.00	1.00	2.00	1.00	2.00
Maximum	103	90	103	108	66	108
Ego Network Homophily:						
Gini Coef. for Node Degree	0.35	0.36	0.34	0.58	0.59	0.59
Mean Sexuality Score	0.893	0.917	0.906	0.932	0.197	0.414
Median Sexuality Score	1.000	1.000	1.000	1.000	0.333	1.000

Note: a Percent totals may not sum to 100.0% due to rounding error.

b Bisexual nodes have an egocentric sexuality score with an absolute value not equal to 1.

Appendix Table 3.2 Sexuality by Gender for Adult Film Industry Sample (1,065 Nodes and 2,033 Edges) from WDW Network [a]

	Men		**Women**		**Total**	
Sexuality:	***n*:**	**%:**	***n*:**	**%:**	***n*:**	**%:**
Bisexual [b]	3	1.0	227	30.2	230	21.6
Gay/Lesbian	10	3.2	192	25.6	202	19.0
Straight	301	95.9	332	44.2	633	59.4
Total Obs:	**314**	**29.5**	**751**	**70.5**	**1,065**	**100.0**

Note: a Percent totals may not sum to 100.0% due to rounding error.

b Bisexual nodes have an egocentric sexuality score with an absolute value not equal to 1.

4.1 Appendix D – Additional Sample Demographics for WDW Network

-- APPENDIX FIGURE 4.1 ABOUT HERE --

-- APPENDIX FIGURE 4.2 ABOUT HERE --

Appendix Table 4.1 Additional Demographic Statistics on Nationality and Race/Ethnicity for WDW Network (109,626 Nodes and 88,746 Edges) [a]

Demographic Characteristic:	**Count** *n*:	**Percent** %:	**Valid Percent** %:
Nationality: [b]			
African	407	0.4	0.6
American/Other English	38,310	35.0	60.0
Asian	2,555	2.3	4.0
Central/South American	3,193	2.9	5.0
European	11,568	10.6	18.1
Middle Eastern	1,010	0.9	1.6
Misc. Islander	587	0.5	0.9
Nordic	1,161	1.1	1.8
Other North American	3,322	3.0	5.2
Russian	1,789	1.6	2.8
NA	45,724	41.7	-
Race/Ethnicity: [c]			
Asian	2,203	2.0	4.0
Black	2,329	2.1	4.2
Hispanic	15	0.0	0.0
Middle Eastern	372	0.3	0.7
Multiracial	4,303	3.9	7.8
Other	74	0.1	0.1
White	45,706	41.7	83.1
NA	54,624	49.8	-
Total Obs:	**109,626**	**100.0**	**-**

Note: a Percent totals may not sum to 100.0% due to rounding error.

b Nationality collapsed (as region of origin) from the “Nationality” profile field on WDW.

c Race/Ethnicity collapsed from the “Ethnicity” profile field on WDW.

Appendix Table 4.2 Additional Demographic Statistics on Occupational Industry for WDW Network (109,626 Nodes and 88,746 Edges) [a]

Demographic Characteristic:	**Count** *n*:	**Percent** %:	**Valid Percent** %:
Occupational Industry: [b]			
Academia	510	0.5	0.8
Arts	2,099	1.9	3.3
Culinary Arts	97	0.1	0.2
Film	30,643	28.0	48.1
Misc. Entertainment	1,564	1.4	2.5
Modeling	3,227	2.9	5.1
Music	7,457	6.8	11.7
Other	306	0.3	0.5
Personality	2,246	2.1	3.5
Politics	1,816	1.7	2.9
Professions	1,619	1.5	2.5
Relatives	1,079	1.0	1.7
Sports and Games	5,830	5.3	9.2
TV and Radio	2,687	2.5	4.2
Writing	2,560	2.3	4.0
NA	45,886	41.9	-
Total Obs:	**109,626**	**100.0**	**-**

Note: a Percent totals may not sum to 100.0% due to rounding error.

b Occupational Industry collapsed from the “Occupation” profile field on WDW.

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