

## FRIENDSHIP JEALOUSY

Friendship jealousy: One tool for maintaining friendships in the face of third-party threats?

Jaimie Arona Krems<sup>1\*</sup>, Keelah E. G. Williams<sup>2</sup>, Douglas T. Kenrick<sup>3</sup>, & Athena Aktipis<sup>3</sup>

### Author note:

<sup>1</sup> The Oklahoma Center for Evolutionary Analysis (OCEAN), Department of Psychology, Oklahoma State University

<sup>2</sup>Department of Psychology, Hamilton College

<sup>3</sup>Department of Psychology, Arizona State University

\* Corresponding author: Jaimie Arona Krems

Oklahoma State University

Department of Psychology

116 North Murray Hall

Stillwater, OK 74078

Email: [jaimie.krems@okstate.edu](mailto:jaimie.krems@okstate.edu)

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### Abstract

Friendships can foster happiness, health, and reproductive fitness. But friendships end—even when we might not want them to. A primary reason for this is interference from third parties. Yet little work has explored how people meet the challenge of maintaining friendships in the face of real or perceived threats from third parties, as when our friends inevitably make new friends or form new romantic relationships. In contrast to earlier conceptualizations from developmental research, which viewed friendship jealousy as solely maladaptive, we propose that friendship jealousy is one overlooked tool of friendship maintenance. We derive and test—via a series of 11 studies ( $N = 2918$ ) using hypothetical scenarios, recalled real-world events, and manipulation of on-line emotional experiences—whether friendship jealousy possesses the features of a tool well-designed to help us retain friends in the face of third-party threats. Consistent with our proposition, findings suggest that friendship jealousy is (1) uniquely evoked by third-party threats to friendships (but not the prospective loss of the friendship alone), (2) sensitive to the value of the threatened friendship, (3) strongly calibrated to cues that one is being replaced, even over more intuitive cues (e.g., the amount of time a friend and interloper spend together), and (4) ultimately motivates behavior aimed at countering third-party threats to friendship (“friend guarding”). Even as friendship jealousy may be negative to experience, it may include features designed for beneficial—and arguably prosocial—ends: to help maintain friendships.

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Inevitably, our friends become close with other people, as when they make new friends or form new romantic relationships. How do we feel when this happens? Speaking to *The New York Times*, author Andrea Lavinthal confessed: “Most girls won’t admit this, but they’d rather you hit on their significant other than their best friend” (Alford, 2014). We propose Lavinthal is not unusual in experiencing a stab of “friendship jealousy” at the thought of a best friend becoming especially close with someone else. Even as friendship jealousy might be unpleasant to experience—and perhaps even embarrassing to acknowledge—it may function to help people maintain their valued friendships.

Most descriptions liken “being jealous” to feeling some mixture of sadness, anger, and anxiety (Bringle, 1991; Hupka, 1991; Parrott & Smith, 1993; Sharpsteen, 1991; Sharpsteen & Kirkpatrick, 1997). Research on jealousy has focused mostly on the domain of sexual and/or romantic relationships (e.g., Bhugra, 1993; Buss, 2000, 2013; Buss & Haselton, 2005; Buunk, 1981, 1982; DeSteno & Salovey, 1996; DeSteno, Valdesolo, & Bartlett, 2006; Freud, 1910). Yet jealousy is not unique to mating relationships, as historical, anthropological, non-human animal, and even some modern empirical evidence can attest (e.g., Buss, 2013; Campos, Walle, & Dahl, 2010; Hruschka, 2010; Parker, Low, Walker, & Gamm, 2005). Here, we explore jealousy in a distinct social domain—friendship. We also propose that friendship jealousy might differ from romantic jealousy in several important ways.

Whereas romantic jealousy is presumed to facilitate mate retention in the face of real or perceived third-party threats to romantic relationships (e.g., Buss, 1988, 2013; Buss & Shackelford, 1997; Buss, Shackelford, & McKibbin, 2008), we reason that friendship jealousy might be evoked by and guide responses to real or perceived third-party threats to valued friendships. In terms of similarities, both romantic relationships and friendships are core components of daily life (e.g., Hruschka, 2010; Perlman, Stevens, & Carcedo, 2015). Evidence suggests that, like romantic

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relationships, friendships can facilitate health, happiness, and even reproductive fitness (e.g., DeScioli & Kurzban, 2009, 2011; DeScioli, Kurzban, Koch, & Liben-Nowell, 2011; Dunbar, 2017; Lewis et al., 2011; Seyfarth & Cheney, 2012; Tooby & Cosmides, 1996). Moreover, just as people compete to attract romantic partners—sometimes luring them away from existing relationships—people engage in social competition to attract friends (e.g., Barclay, 2013, 2016; Eisenbruch & Roney, 2017). Indeed, people frequently report that third parties harm friendships (e.g., Rose 1984). Thus, we should expect that, just as people possess responses suited to retaining their mates in the face of third-party interference, people might also possess responses suited to retaining their friends in the face of third-party interference (e.g., DeScioli & Kurzban, 2009, 2011; Rose, 1984).

Although substantial research has addressed the recurrent challenges of mate retention and romantic relationship maintenance (e.g., Buss & Shackelford, 1997; Buss et al., 2008; Conroy-Beam, Goetz, & Buss, 2016; Gangestad, Thornhill, & Garver, 2002; Kenrick, Griskevicius, Neuberg & Schaller, 2010; Kenrick, Neuberg, Griskevicius, Becker & Schaller, 2010; Pillsworth & Haselton, 2006; Welling, Puts, Roberts, Little, & Burriss, 2012), far less work has explored strategies for friend retention and friendship maintenance (Canary, Hause, Stafford, & Wallace, 1993; Fehr, 1996; Hays, 1985; Oswald & Clark, 2006; Oswald et al., 2004; Rose & Serafica, 1984; Rusbult, Olsen, Davis, & Hannon, 2004). A consideration of the recurrent challenges of friendship maintenance leads to several predictions about the architecture of friendship jealousy, which we test here.

### **Jealousy Can Protect Valued Social Relationships**

The experience of jealousy is considered aversive, and it has been widely described as a blend of sadness, anger, and anxiety (e.g., Sharpsteen, 1991). Researchers working at various levels of analysis largely agree that jealousy is evoked when relationships are threatened by others, and can motivate behavior aimed at countering those threats (e.g., Buss, 2013; Buss, Larsen, Weston, & Semmelroth,

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1992; Buunk, Angletiner, Oubaid, & Buss, 1996; Daly, Wilson, & Weghorst, 1982; DeSteno & Salovey, 1996; DeSteno et al., 2006; Panksepp, 2010; Sagarin, 2005; Seyfarth & Cheney, 2012). In the prototypical example, one becomes jealous upon perceiving that a third party is interested in one's partner and/or that one's partner is interested in that third party (Daly et al., 1982; Salovey, 1991).<sup>1</sup> However, different types of jealousy may be at work in different social domains, be activated by qualitatively different threats, and motivate behavior that protect qualitatively different relationships. For example, just as romantic partners may be jealous at the attention their spouses give rivals, a child may be jealous at the attention a caregiver lavishes on that child's siblings (e.g., Miller, Volling, & McElwain, 2000)—indeed, behavior consistent with jealousy appears as early as the first year of life (Campos et al., 2010).<sup>2</sup>

The flourishing work on romantic jealousy provides an initial springboard for exploring the understudied phenomenon of friendship jealousy. Specifically, researchers taking an evolutionary approach to romantic jealousy have found evidence consistent with the propositions that—because successfully maintaining romantic relationships likely increased reproductive fitness in ancestral environments, and because third parties posed recurrent threats to the

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<sup>1</sup> Colloquially, “jealousy” and “envy” are often used interchangeably. However, the former is evoked by the threatened loss of an existing bond, whereas the latter is evoked when one covets something someone else has (and that the envious person lacks; DelPriore, Hill, & Buss, 2012).

<sup>2</sup> Because evolution works by descent with modification, jealousy over friendships (friendship jealousy) could have been built upon the foundations laid for *sibling* jealousy or *mating* jealousy—or vice versa. We focus here not on the phylogeny of friendship jealousy, but rather on the features that it might have if, like romantic jealousy, it functioned to help maintain valued but potentially threatened social bonds.

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maintenance of those relationships—romantic jealousy is likely one adapted tool of partner retention (e.g., Buss, 2000, 2013; Buss & Haselton, 2005; Daly et al., 1992; Scelza et al., 2019; Symons, 1979).<sup>3</sup> Behavior consistent with romantic jealousy may be evidenced in some non-human animals; among humans, it exists across cultures, and it possesses features that appear to be well-designed to solve the recurrent problem of retaining mates in the face of third-party threats: (a) romantic jealousy is evoked by cues that a romantic partner stands to be lost to a third party; (b) cues with better predictive validity of impending loss receive prioritization in driving levels of romantic jealousy; and (c) romantic jealousy spurs a suite of behavioral inclinations, known as mate guarding, that are theoretically aimed at countering the threat of partner loss (Buss, 2000, 2013; Buss & Haselton, 2005; Buss et al., 1992; Buss & Shackelford, 1997; Buunk, 1997; Lewis et al., 2016; Scelza, 2014; Scelza et al., 2019; Schmitt & Pilcher, 2004). Here, we conduct a similar investigation of friendship jealousy, first making a case for the importance of friendships and the recurrent challenge of third-party threats to them.

### **Friendship: Beneficial Bonds**

Friendships, defined as sustained medium- to long-term cooperative alliances between genetically unrelated conspecifics (DeScioli & Kurzban, 2009; Perlman et al., 2015), are a human

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<sup>3</sup> This is not to say that any behavior spurred by such jealousy is, today, fitness-enhancing or morally good; rather, this argument supposes that, even if some people occasionally reduced their fitness via harming their mates (e.g., in fits of jealousy-induced rage), on average, those people who experienced romantic jealousy were likely to have been more successful at maintaining their valued romantic relationships in the face of third-party threats—and thus would have enjoyed greater reproductive success—than those who failed to experience romantic jealousy under the same circumstances.

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universal (Hruschka, 2010) and may also exist across non-human species (e.g., Seyfarth & Cheney, 2012; Silk, 2002, 2003). Among humans, friendships are considered central to health, happiness, and well-being by laypersons and researchers alike (Adams & Allan, 1998; Fehr, 1996; Dunbar, 2017; Hruschka, 2010; Perlman, et al., 2015). For example, Americans report valuing their friends as much as they value money and employment—behind only health and family (Gallup Poll News Service, 2005), and people view friendships as a primary means to achieve a meaningful life (Benenson, 2014; Campbell, 2002; Kenrick & Krebs, 2018; Krebs, Kenrick, & Neel, 2017; Perlman & Peplau, 1981; Smith & Christakis, 2008) Indeed, the survivability and health benefits of maintaining friendships may be second only to those benefits accrued by quitting smoking (Dunbar, 2017; Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015).

In line with this, some theory and evidence suggest that friendships have positive effects on fitness, defined in evolutionary terms. This makes sense, as friends have long been considered important sources of social, emotional, and material support (e.g., Campbell, 2002; Cottrell, Neuberg, & Li, 2007; Davis & Todd, 1982; Hruschka, 2010; Plickert, Cote, & Wellman, 2007). Research from Western cultures, studies in small-scale societies around the world, and even primatology suggest that sustained friendships might bolster fitness via a number of routes: by promoting an individual's survival, providing status and resources, mitigating the negative impact of both physical and social threats, helping individuals win agonistic conflicts, and/or improving the longevity of offspring (Ackerman, Kenrick, & Schaller, 2007; Aktipis et al., 2018; Barakzai & Shaw, 2018; Barclay, 2013; Campbell, 2002; David Barrett et al., 2015; DeScioli & Kurzban, 2009, 2011; DeScioli et al., 2011; Dunbar, 2017; Hrdy, 2011; Hruschka, 2010; Lewis et al., 2011; Roberts, 2005; Shaw, Choshen-Hillel, & Caruso, 2018; Shaw, DeScioli, Barakzai, Kurzban, 2017; Silk, 2003, Silk et al., 2003; Seyfarth & Cheney, 2012; Sugiyama, 2004; Tooby & Cosmides, 1996; Trivers, 1971).

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Several specific theories have been proposed to account for how friendship might have bolstered fitness in ancestral environments. Whereas traditional theorizing emphasized the reciprocal exchange of goods and support (e.g., Trivers, 1971), more recent theories have moved beyond the notion of dyadic reciprocation to explore how friendships might have helped humans survive and thrive in small, densely interconnected social groups (Barclay, 2013, 2016; DeScioli & Kurzban, 2009, 2011; DeScioli et al., 2011; Tooby & Cosmides, 1996). For example, Tooby and Cosmides (1996) suggest that friendships helped resolve the recurrent challenge of accessing support when ill or injured. Because friends have a stake in one another's welfare, they often provide the much-needed support that strangers would be unlikely to provide. Some evidence from hunter-gatherer studies supports this theorizing (e.g., Sugiyama, 2004). A similar account is the *Alliance Hypothesis for Human Friendship*, which holds that friendship arises, in part, from cognitive mechanisms designed to assemble support for future conflicts (DeScioli & Kurzban, 2009, 2011; DeScioli et al., 2011). On this view, when social conflicts arose in small, interconnected groups, (a) people likely knew both disputants, and (b) as in most conflicts, the disputant with more supporters would win. Given the dynamics in small groups, having even just one close friend put their support behind you could make the difference between winning a conflict (e.g., surviving) and losing (e.g., dying).<sup>4</sup>

### **The Challenge of Friendship Maintenance**

Despite their phenomenological and objective worth, even valued friendships can wane or end

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<sup>4</sup> Consider a group in which Steve, Tony, and Bucky are all friends, but Tony and Bucky have a conflict. Whichever friend Steve supports in the conflict will win. According to the Alliance Hypothesis, Steve is likely to throw his support behind the disputant most likely to support him in future conflicts (say, Bucky). By protecting Bucky, Steve thus also increases the likelihood that he will prevail in future conflicts, for he has protected a likely supporter.



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(Casper & Card, 2010; Rose, 1984; Rose & Serafica, 1986; Wellman, Wong, Tindall, & Nazer, 1997). For example, Wellman and colleagues (1997) found that, over the course of a decade, roughly 60% of friendships among working- and middle-class Canadians ended, with roughly half of *sustained* friendships becoming significantly less close. Of course, friendships end for numerous reasons (de Vries & Johnson, 2002; McEwan, Babin Gallagher, & Farinelli, 2008; Rose, 1984). Importantly, a primary and frequently-cited reason that people give for the dissolution of friendships *they wished to maintain* is interference from third parties (e.g., Parker, Kruse, & Aikens, 2010; Owens, Shute, & Slee, 2000; Rose, 1984; Tannen, 2017). Indeed, multiple studies have found that children and adults both cite third-party interference as having caused the dissolution or diminution of a friendship (Bigelow, Tesson, & Lewko, 1996; McEwan et al., 2008; Silverman, Greca, & Wasserstein, 1995).

People clearly perceive third parties as possible threats to friendship maintenance, and such perceptions might be sufficient to evoke friendship jealousy, but do third parties truly threaten friendships? Laypeople and researchers alike might intuitively resist the notion that one can “lose” friends to other people—even as many readily accept that romantic relationships can be lost to others. It is true that norms of exclusivity can differ for friendly versus monogamous romantic relationships, and people generally perceive that friendly affection is less zero-sum than romantic affection (e.g., Davis & Todd, 1982; Sprecher & Regan, 2002). Nevertheless, several independent lines of research suggest that third-party interference may be a longstanding and genuine challenge to friendship maintenance.

First, whenever individuals have some choice in picking their partners, and partners vary in desirability, individuals compete over desirable partners. Many theories of cooperation, including those dealing with human friendship, thus include presumptions that individuals compete for desirable partners (e.g., Barclay, 2013, 2016; Bird, Bird, Coddington, Zeanah, 2019; Delton & Robertson, 2012; DeScioli & Kurzban, 2009, 2011; Krems & Conroy-Beam, 2020; Nesse, 2007; Noe & Hammerstein,

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1994; Tooby & Cosmides, 1996). Even among the small-scale groups of non-human primates, individuals compete for access to desirable ‘friends’ (e.g., Palombit, Cheney, Seyfarth, 2001; Seyfarth & Cheney, 2012). A primary implication of theories involving partner choice is “the possibility of abandonment by one’s current partner in favor of a rival” (Barclay, 2013, p.172).

Second, robust research suggests that a person can maintain only so many relationships at any one time, whether because we have finite time to invest in these relationships (Dunbar, 1993, 2008; Milardo, Johnson, & Huston, 1983; Roberts & Dunbar, 2011; Roberts, Dunbar, Pollet, & Kuppens, 2009; Zhou, Sornette, Hill, & Dunbar, 2005), and/or because we may be able to keep close track of only so many relationship partners at once (Hall, Larson, & Watts, 2011; Krems, Dunbar, & Neuberg, 2017; Krems & Wilkes, 2019; Miritello et al., 2013; Oswald, Clark, & Kelly, 2004). For example, relationships require time to build and to maintain (e.g., Miritello et al., 2013; Oswald et al., 2004), but time is a notably inelastic resource. Evidence suggests that when a person forms a new, close relationship and/or becomes newly close with an existing relationship partner, this can cause one or more previous occupants of the friend’s innermost circle of affection to be relegated to an outer, less close circle (Dunbar, 2012; Roberts et al., 2009; Zhou et al., 2005). Further, this line of work might imply—likely in line with lay intuitions—that we feel the most threatened when potential interlopers consume our friends’ time.

Third, explicitly evolutionary views of friendship hold that third parties posed recurrent threats to friendship maintenance. For example, Tooby and Cosmides (1996) propose that people have only so many friendship slots, or niches; people attempt to become irreplaceable to friends to protect their niches from being usurped by others, and thus to continuing enjoying the benefits associated with those friendships (e.g., provisioning, social support). Somewhat similarly, the Alliance Hypothesis contends that a person’s friends are ranked hierarchically in descending

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order of those one would support in a conflict (e.g., between one's own friends; DeScioli & Kurzban, 2009, DeScioli et al., 2011). All things equal, if a man's best friend (first-ranked friend) had a conflict with his fourth-ranked friend, that man would support his best over his fourth-ranked friend, and two best friends should support one another over anyone else. But if your best friend became closer to someone else, you would move down in your best friend's rankings, and thus be less likely to enjoy your best friend's support in prospective conflicts with the very person who usurped your rank. Counter to lay intuitions, then, this work might imply that third parties will be perceived as threats insofar as they stand to replace us in our preferred niche or hierarchical ranking.

**Known friendship maintenance tactics.** It is widely acknowledged that most bonds require some maintenance to sustain (Burt, 2000; Cummings, Lee, & Kraut, 2006; Oswald et al., 2004; Oswald & Clark, 2006). Just as romantic relationship maintenance is considered a two-pronged challenge, involving maintaining a partner's continued investment in the bond and preventing that partner's loss or defection to someone else (Kenrick, Griskevicius, et al., 2010; Kenrick et al., 2010), so too might friendship maintenance involve both of these challenges.

Again, the bulk of existing relationships research has focused on how people meet these challenges in romantic relationships; however, some work has focused explicitly on friendships. This friendship work has been largely descriptive, taking a data-driven approach to cataloging the tactics people report using (Canary, Hause, Stafford, & Wallace, 1993; Fehr, 1996; Hays, 1985; Oswald & Clark, 2006; Oswald et al., 2004; Rose & Serafica, 1984; Rusbult, Olsen, Davis, & Hannon, 2004). For example, Oswald and colleagues (2004) developed a typology of friendship maintenance strategies, including being positive around friends, being supportive, and spending time together. Others have cited the importance of avoiding sensitive issues and making one another laugh (e.g., Bigelow & LaGaipa,

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1975; Burleson & Samter, 1994; Canary et al., 1993).

We propose that these tactics are well-suited to meet only one of the two central challenges of friendship maintenance. For example, being positive around friends and making them laugh might help maintain friends' continued investment, but these tactics do not seem especially well suited to mitigate a friend's loss or defection to someone else. On the other hand, friendship jealousy may be especially well designed to do just that.

### **Friendship Jealousy: Existing Work and New Predictions**

Before we outline our predictions, we first overview existing work on friendship jealousy, which yields contrasting views that friendship jealousy is maladaptive or pathological.

**Existing research on friendship jealousy.** In developmental psychology, there is some work on jealousy in friendships, which has built upon the theoretical foundations laid by Selman and colleagues (e.g., Selman, 1980; Selman & Schultz, 1990). Selman expected that jealousy over friends abates after adolescence, when "social-cognitive advances help older children take a more balanced view in which they recognize that no single relationship, no matter its quality, can meet all the interpersonal needs of an individual" (Parker et al., 2005, p. 236). This work implies that, although children and adolescents might experience friendship jealousy, normally-developing adults likely do not.

Accordingly, related empirical research has almost exclusively examined children and adolescents, and it has focused on the negative antecedents and outcomes of friendship jealousy (Kraft & Mayeux, 2016; Lavalley & Parker, 2009; Parker, Campbell, Kollat, & Lucas, 2008; Parker, Ebrahimi, & Libber, 2005; Parker et al. 2010; Parker, Ramich, & Roth, 2009; Roth & Parker, 2009). For example, children with low self-esteem may have a high "vulnerability" to friendship jealousy (Ebrahimi, Parker, Lavalley, & Seiffke-Krenke, 2005; see also Bhugra, 1993), children who experience such jealousy may have lower friendship satisfaction (Giltensboth, 2001; Lavalley & Parker, 2009;

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Parker & Wargo Aikens, 2009), and children with a reputation for jealousy may be less accepted and perhaps also more frequently victimized by their peers (Parker et al., 2010; Parker & Gamm, 2003).

We do not dispute the validity of these findings. However, taking a functional perspective raises some questions about the underlying theorizing. For example, if friendship jealousy consistently causes *solely* negative outcomes, why does it remain so prevalent across eras, cultures, and perhaps even species? In the historical and ethnographic records, for example, there are numerous accounts of children and adults reacting with jealousy when friends seem to prefer the company of others (e.g., Hruschka, 2010; Rose, 1984; Tannen, 2017; Yalom & Brown, 2015). One possible way to reconcile empirical evidence for friendship jealousy's negative outcomes with its continued prevalence is to recognize that existing theorizing has led researchers to expect only—and thus to test for only—negative antecedents and outcomes of friendship jealousy. A functional perspective expects that, even if friendship jealousy can be aversive to experience and occasionally harm friendships, on average, those who experienced it may have been better able to maintain their friendships (and associated benefits) than those who failed to experience friendship jealousy in the same situations.

**Predictions from a functional perspective.** If friendship jealousy arose as one tool of friendship maintenance, our modern psychologies might still possess several specific features. As described in more detail below, in a series of 11 experiments, we investigate: (a) what cues do (and do not) evoke friendship jealousy; (b) whether some cues evoke greater friendship jealousy than others; (c) what behavior friendship jealousy might motivate; and (d) the specificity of friendship jealousy for this role as a tool of friendship maintenance—that is, whether friendship jealousy (versus the often-concomitant emotions of sadness and/or anger) is uniquely evoked by third-party threats to friendships, and/or uniquely motivates threat-counteracting responses.

*Evoked by third-party threats to friendship (but not friendship loss in general).* Although we

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expect reports of sadness and/or anger to be concomitant with friendship jealousy—as jealousy is both theorized to be and reported to feel like a mix of these emotions (e.g., Bringle, 1991; Sharpsteen, 1991)—a functional approach expects that friendship jealousy will be evoked by the possible loss of a valued friendship *to a third party*. We contrast this with the threatened loss of the friendship alone (e.g., as when a friend spends more time at work). Whereas the threatened loss alone should be sufficient to evoke sadness and anger, only the threatened loss of a friend *to a third party* should evoke high levels of friendship jealousy (even as this might also evoke sadness and/or anger; Hypothesis 1). This prediction speaks to the cues that do (and do not) elicit friendship jealousy, and also begins to differentiate friendship jealousy from often-concomitant emotions.

***Calibrated to friend value.*** At any one time, we might have multiple friends—a best friend, close friends, and perhaps some friendly acquaintances—with closer friendships providing more numerous and potentially more important benefits. Thus, the prospective loss of each of these friends should evoke different amounts of friendship jealousy. We expect that friendship jealousy will be sensitive to the value (i.e., closeness) of the threatened friendship (Hypothesis 2). This prediction speaks to one cue to which friendship jealousy might be calibrated.

***Calibrated to cues of replacement.*** Functional accounts of friendship imply that the most powerful cues that a friendship is threatened would be *replacement threats*, or cues that the possible interloper stands to usurp one’s place in the friendship. In contrast, intuition—and perhaps also friendship accounts emphasizing finite resources required for relationship maintenance (e.g., time)—imply that friendship jealousy would be most closely calibrated to the amount of *time* a best friend spends with the possible interloper. Although the amount of time a best friend spends with a person can be a cue to the stability of that person’s position in the friendship hierarchy or niche (i.e., to replacement threat), it is not determinative: one’s best friend can spend more time with others while

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still prioritizing one most of all. Consider, for example, that your best friend may spend 40 hours a week with “work buddies,” 20 hours with a new romantic partner, and only 3 hours a week with you, but neither the work colleagues nor the romantic partner threaten your status as best friend. By contrast, when your best friend prioritizes another friend over you (i.e., replaces you in the hierarchy or friendship niche) you stand to lose the potentially fitness-enhancing friend-mediated benefits (Burkett, 2009; DeScioli & Kurzban, 2009, 2011; DeScioli et al., 2011; Tooby & Cosmides, 1996).

Thus, whereas time spent together can be a cue of replacement threat, friendship jealousy should be strongly calibrated to more direct cues of replacement threat (e.g., a best friend supporting the interloper over you; Hypothesis 3). We test between these predictions in several distinct but complementary ways. This prediction speaks to how friendship jealousy is calibrated.

***Motivates behavior to counter threats.*** From a functional perspective, thoughts and feelings motivate threat-countering action (e.g., Nesse, 2019; Neuberg, Kenrick, & Schaller, 2010; Sznycer, et al., 2016). Thus, friendship jealousy (but not necessarily sadness and/or anger alone) should motivate behavior aimed at maintaining the threatened friendship—what we term “friend guarding” (Hypothesis 4). This prediction speaks to the behavioral outputs of friendship jealousy, and also differentiates friendship jealousy from often-concomitant emotions.

**Research overview.** Should these predictions find support in the 11 studies we report below, the present work would achieve several ends. Specifically, we would provide some of the first empirical evidence for a novel theory of friendship jealousy—a phenomenon that, although seemingly common (e.g., Alford, 2014; Rosenfeld, 2004; Hruschka, 2010), remains largely unexplored. Second, results would elucidate the architecture of friendship jealousy in ways similar to other recent research on discrete emotions (e.g., Sell et al., 2009; Sell et al., 2018; Shi et al., 2015; Sznycer, 2019; Sznycer et al., 2017; Sznycer, Cosmides & Tooby, 2017; Sznycer et al., 2018a, 2018b; Tracy & Robins, 2006;

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Tracy, Shariff, & Cheng, 2010): showing what inputs do (and do not) evoke friendship jealousy, which cues are prioritized in driving it, and which behavioral outputs it motivates. Third, predicted findings would challenge existing conceptualizations of friendship jealousy from both early research and lay intuitions (Selman, 1980; Sharp & Welty, 1991)—that friendship jealousy is solely negative—instead aligning with functional research on negative affect serving some beneficial ends.

### Study 1

The experience of jealousy may feel like a mix of sadness and anger (e.g., Bringle, 1991; Sharpsteen, 1991). However, to the extent that jealousy is a distinct reaction well-suited for protecting friendships against third-party interference, it should be uniquely sensitive to third-party threats, whereas sadness and anger might not be. We predict that friendship jealousy will be strongly evoked by third-party threats to same-sex best friendships (relative to threatened loss of the friendship alone), whereas sadness and anger might be evoked in both situations.

### Method

**Participants.** We determined we would need approximately 42 participants for .80 power to detect small to medium effects ( $f = .20$ ) assuming measurement correlation = .5. Fifty-six undergraduate students (20 females, 1 not reporting sex;  $M_{age} = 20.35$ ;  $SD_{age} = 1.51$ ) were recruited into an in-laboratory study and received course credit for participation in a 30-minute study. All participants who completed the focal dependent variables were included in analyses.

**Procedure and design.** Participants were asked to give the names (first name, last initial) of same-sex others they saw in their day-to-day lives: a best friend, a close friend, and an acquaintance. Each friend type was defined for participants (e.g., “a best friend is the ONE person to whom you are closest, a person who would help you in dire times”). Best friends’



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names were then piped into questions asking about that friend. We did not later ask about close friends and acquaintances; this information was gathered to obscure our focal aims.

Participants then gave short responses to open-ended questions about the primary activity and functionality of best friendships (“What is the primary activity that you and [name of best friend] do together?”; “What is the primary function that you fulfill for [name of best friend]? That is, what is it about your friendship that [name of best friend] could not live without, or that [name of best friend] would lose if you were no longer best friends?”). Responses were piped into the four focal questions (described below) asking about reactions to the loss of the friendship (alone versus to a third party). Questions appeared in randomized order.

To assess reactions to *the loss of the best friendship alone*, participants were asked (1) “If [name of best friend] stopped doing [activity] with you, would you feel...?” and (2) “If [name of best friend] stopped relying on you and your friendship for [function], would you feel...?”

To assess reactions to *the loss of the best friendship to a third party*, participants were asked (3) “If [name of best friend] started doing [activity] with another person---a same-sex stranger---instead of you, would you feel...?” and (4) “If [name of best friend] started relying on someone else---a same-sex stranger---for [function] instead of relying on you, would you feel...?”

In both conditions, reactions were assessed on a 7-point Likert-scale (1 = *Not at all*, 7 = *Very much*). Responses assessed included friendship jealousy (“jealousy”), emotional reactions often considered concomitant with jealousy (“sadness”, “anger”), and three distractor emotions (“happiness”, “pride”, “disgust”). Each reaction item appeared in random order. Reactions were aggregated across activity and function questions to compute reactions.

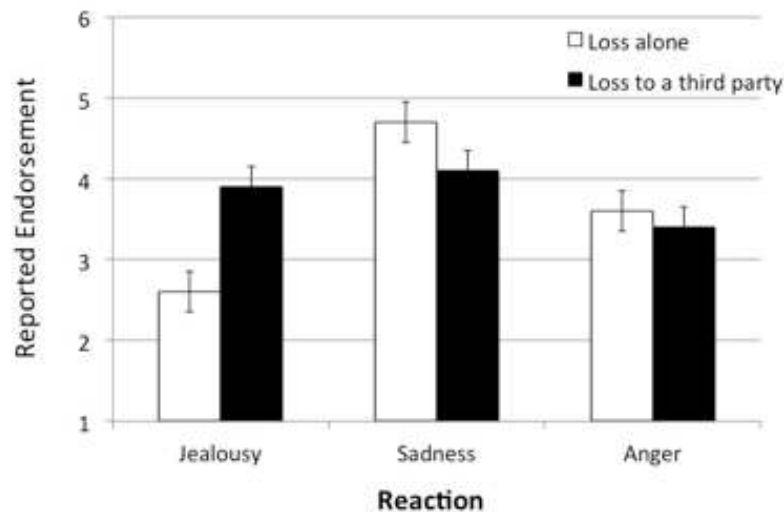
**Other measures.** In this and subsequent studies, we included items not germane to focal predictions and not analyzed here, including exploratory measures (e.g., fitness interdependence; Aktipis et al., 2018) individual differences (e.g., self-esteem; Rosenberg, 1959), and demographic questions (e.g., age, ethnicity). All measures throughout were IRB-approved.

## Results and Discussion

We compared feelings of jealousy, sadness, and anger across conditions. The resultant 2 [Condition: loss of friendship, loss of friendship to a third party] x 3 [Reactions: jealousy, sadness, anger] within-subject Analysis of Variance (ANOVA) revealed a main effect of Reaction,  $F(2, 108) = 27.10, p < .001, \eta_p^2 = .334$ , qualified by the predicted Condition x Reaction interaction,  $F(2, 108) = 49.93, p < .001, \eta_p^2 = .480$ . The main effect of Condition was not significant ( $p = .202$ ). (Means [SEs] for all main and distractor responses are reported in Table S1 in the Supplementary Material available online.) We also tested whether these findings—and all those reported below—held across genders. Findings for friendship jealousy, as described above, held for both men and women, separately (see Supplementary Material).

First, as predicted, reported friendship jealousy was greater in the loss to a third party condition ( $M = 3.86, SE = 0.28$ ) than it was in the loss alone condition ( $M = 2.57, SE = 0.23, p < .001, 95\%CI = [0.90, 1.67], \eta_p^2 = .450$ ). See Figure 1. Importantly, this pattern of responding is consistent with the prediction that friendship jealousy is strongly evoked only by the threat of losing a friend *to a third party* (and not by the threat of losing a friend). In contrast, reported sadness was greater in the loss alone condition ( $M = 4.69, SE = 0.25$ ) than in the loss to a third party condition ( $M = 4.08, SE = 0.30, p < .001, 95\%CI = [0.30, 0.92], \eta_p^2 = .225$ ). Condition did not significantly influence reported anger ( $M_{loss\ alone} = 3.57, SE_{loss\ alone} = 0.28; M_{loss\ third\ party} = 3.39, SE_{loss\ third\ party} = 0.27; p > .250$ ).

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**Figure 1.** Reported levels of friendship jealousy and related emotions of sadness and anger in reaction to losing a best friendship (alone) versus losing a best friendship to a third party (e.g., to a best friend’s new friend). Error bars represent standard errors.

Moreover, in the loss alone condition, both reported sadness and anger were greater than friendship jealousy ( $ps < .001$ ). This was not the case in the loss to a third party condition; both jealousy and sadness were greater than anger in this condition ( $ps < .005$ ), although jealousy and sadness were statistically indistinguishable from one another ( $p = .131$ ).

### Discussion

Consistent with our theorizing that friendship jealousy is relevant for dealing specifically with third-party interference in friendships, only friendship jealousy (and not sadness or anger) is relatively strongly evoked by third-party threats to friendships (versus the loss of the friendship alone). The differences in reactivity to these two conditions is especially striking because both the threatened losses yield the same ends (loss of the friendship and related benefits). In Study 2 we further explore the possible specificity of friendship jealousy, not only as being uniquely

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evoked by third-party threats to friendships, but also as uniquely motivating behavioral intentions to counter those threats.

### Study 2

Study 2 facilitated several goals. First, we aimed to replicate findings from Study 1—that friendship jealousy is strongly evoked by third-party threats to best friendships, whereas sadness and anger, although often-concomitant with jealousy, are not—here, using a between-subjects design and an alternative sample. Thus, to replicate findings from Study 1, participants again reported their friendship jealousy at the prospective loss of their best friendships (alone) or to third parties.

Second, we aimed to test whether friendship jealousy (versus often-concomitant emotions) motivates friend guarding. We measure friend guarding intentions by adapting a well-established tactic of mate guarding: vigilance toward possible rivals (e.g., Buss, Shackelford, & McKibben, 2008; Shackelford, Goetz, & Buss, 2005). We predict that (i) third-party threats to best friendships will evoke more friendship jealousy than the threatened loss of the friendship alone, and, in turn, that (ii) this friendship jealousy (but not sadness or anger) will motivate greater behavioral intentions to engage in friend guarding. This is not to say that third-party threats evoke neither sadness nor anger. Rather, we simply doubt that sadness and/or anger, alone, would be responsible for motivating friend guarding—a prediction consistent with existing emotions work. For example, to the best of our knowledge, no existing, parsimonious theorizing argues that sadness or anger, alone, spur partner guarding; by contrast a sizeable body of work on romantic jealousy has produced cogent theorizing and supportive empirical evidence that romantic jealousy causes people to engage in mate guarding (see, e.g., Buss, 2013).

The third aim of Study 2 is to discriminate between types of friendship maintenance behavior. As noted above, friendship maintenance is a two-pronged challenge that involves both mitigating a friend's loss or defection to someone else (the focus here) but also maintaining a friend's continued

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investment in the bond (the primary focus of existing friendship research). Whereas we term behavior aimed at preventing the defection of a friend to a third party “friend guarding”—likely comprised of tactics such as vigilance (e.g., knowing if the best friend is with the potential interloper; e.g., Buss et al., 2008) —we term behavior aimed at securing a friend’s continued investment in the relationship “everyday friend retention”—likely comprised of tactics such as making one another laugh and being open with one another (e.g., Canary et al., 2003, Oswald et al., 2004). To explore this, we added a third condition: a no-information control condition. Participants reported their intent to engage in both types of friendship maintenance in response to the threatened loss of the friendship alone, a third-party threat, or a no-information control. (Participants in the no-information control condition did not report their affective reactions to the conditions.)

We predict that (iii) people will report greater intentions to engage in friend guarding-vigilance when third-party threats are salient (loss to a third-party condition) than not (no-information control condition). We do not have strong predictions about possible differences in friend guarding between the loss to a third party and loss alone conditions. On one hand, the loss alone condition makes no mention of a third party, implying people might not increase their vigilance to possible interlopers. But on the other hand, the friendship is still waning, and third-party interference may be one assumed reason why; thus, people might increase their vigilance to possible interlopers—though, still likely not to the same extent that they would when a third-party is explicitly specified.

We also explore whether (iv) people report greater intentions to engage in everyday friend retention in the no-information control condition—reflecting the normal, non-threatened state of friendship—than when third-party threats are salient. (We do not make strong predictions about levels of everyday friend retention intentions in the loss alone versus other conditions.) We explore this because, as noted above, time and energy are inelastic resources, both of which are required to maintain

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relationships. People might be best served by efficiently deploying these finite resources—engaging in the behavior that seems the best tool for the job. When the job is continued friend retention (in the absence of third-party threats), engaging in vigilance over and above everyday friend retention behavior may be superfluous. Note, however, that both friend guarding and everyday friend retention may be usefully recruited when friendships are threatened by third parties. Indeed, we would not assert that these different types of friendship maintenance are completely orthogonal. To the extent that everyday friend retention tactics help people maintain friends' continued investment, third party threats and consequent friendship jealousy could also spur everyday friend retention.

To investigate this, participants completed a two-part experiment in which they were randomly assigned to one of three conditions. After filling in the names of same-sex others—including best friends, which would again be piped into later scenarios—participants reported their reactions to the threatened loss of their best friends (loss alone condition), the threatened loss of their best friends to third parties (loss to third party condition), or were shunted forward in the study without being given a scenario or reporting emotional responses (no-information control condition). The second section of the study assessed intentions to engage in friendship maintenance, with participants in all three conditions reporting behavioral intentions to engage in friend guarding–vigilance and everyday friend retention.

### **Method**

**Participants.** We determined that a sample size of approximately 330 participants was necessary to achieve .80 power to detect small effects ( $f = .15$ ) of differences in two friend retention tactics (friend guarding–vigilance; everyday friend retention) across the three experimental conditions, assuming a .5 correlation between friend retention tactic measures. United States-residing participants were recruited into an approximately nine-minute survey on TurkPrime for small monetary compensation. Whereas over 360 participants began our survey, only 243 (127 female,  $M_{\text{age}} = 36.92$ ,

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$SD_{age} = 11.05$ ) filled out focal dependent variables and passed two data checks. One of these checks was critical to the study, and required participants to have followed directions in writing the first names of three same-sex friends (best friend, close friend, acquaintance). People failed this check if, for example, they wrote the same name for all friends (e.g., Dan, Dan, Dan), if they used names that were clearly not all same-sex (e.g., Eric, Dave, Annie), or if they failed to fill out a name for the best friend. A sensitivity analysis suggests this sample size yielded .80 power to detect an effect size of  $f = .17$ .

**Procedure and design.** Participants were randomly assigned to one of three experimental conditions. Two of these conditions echoed those in the previous experiment (loss alone, loss to a third party); the new condition was a no-information control condition. All participants first reported some brief demographic information and filled in the first names of a same-sex best friend, close friend, and acquaintance. Participants then filled out information about the activities and functions of their best friendship and acquaintanceship, as in Study 1. Only best friend information was germane to the study; as in Study 1, we included other questions to obscure the focal aims.

**Reactions.** In the first main survey section, participants in the loss alone and loss to third party conditions reported their reactions to the prompt. Responses assessed included friendship jealousy (“jealousy”), often-concomitant emotions (“sadness”, “anger”), and distractor emotions (“proud”, “afraid”, “pity”), all of which appeared in random order and were assessed on a 7-point Likert scale (1 = *Not at all*, 7 = *Very much*). Because reporting these reactions in the no-information control condition would have seemed nonsensical, participants in the no-information control condition were advanced to the next survey section directly after providing their friends’ names and friendship activities/functions.

**Friendship maintenance.** In the second main survey section, participants in all three conditions reported how likely they would be to engage in friendship maintenance behavior—both friend guarding-vigilance and everyday friend retention. For example, participants in the loss to a third party condition

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were prompted, “In that situation---where [name of best friend] is becoming potentially closer with a new friend than [name of best friend] is with you---how likely would you be to do each of the following?”, whereas those in the control condition were prompted, “In your best friendship with [name of best friend], how likely would you be to do each of the following?” In all, participants responded to 11 items, appearing in random order, on a 7-point Likert scale (1 = *Not at all*, 7 = *Very much*).

To assess behavioral intentions to engage in the friend-guarding tactic of vigilance to third party threats (*friend guarding–vigilance*), we adapted two items from existing measures of mate guarding (Buss et al., 2008; Shackelford et al., 2005) by drawing from the Mate Retention Inventory – Short Form (MRI-SF; Buss et al., 2008): “Pay attention to whether [name of best friend] was spending time with a new best friend”, “Try to figure out if [name of best friend] prefers a new friend's company to my company” ( $\alpha = .81 - .88$ ).

To assess behavioral intentions to engage in everyday friend retention behavior, we adapted nine items from existing friend retention items (Canary et al., 2003, Oswald et al., 2004), reflecting six everyday friend retention tactics: being positive (“Be cheerful and positive whenever you're with [name of best friend]”), being open (e.g., “Have open discussions with [name of best friend]” [ $\alpha = .76 - .90$ ]), assurances (“Assure each other about the importance of your friendship”), social networks (“Rely on other friends to help you through this rough patch”), avoidance (e.g., “Avoid talking about things that we disagree about” [ $\alpha = .79 - .86$ ]) and humor (“Try to make [name of best friend] laugh”). These were aggregated into one measure of *everyday friend retention* ( $\alpha = .81$ ).

***Other items.*** Participants also completed other exploratory and demographic variables we did not analyze (e.g., intrasexual competitiveness, ethnicity).

## Results

**Is friendship jealousy (versus sadness, anger) uniquely evoked by third party threats? Yes.**



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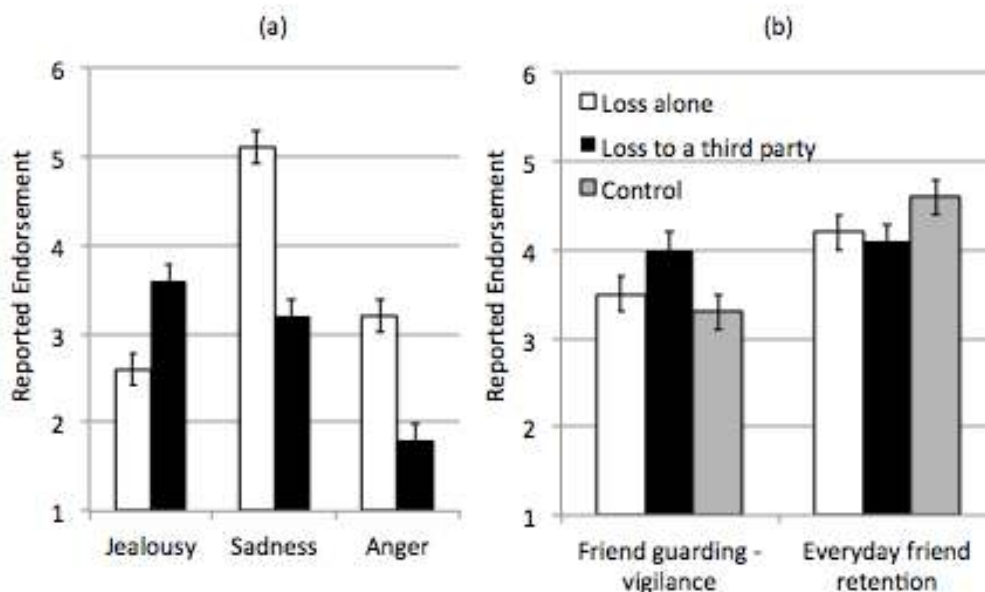
To assess this, we conducted a 2 (Condition: loss alone, loss to a third party) x 6 [Reaction: jealousy, sadness, anger, pride, fear, pity] mixed-factors ANOVA. This yielded significant main effects of Condition,  $F(1, 162) = 6.87, p = .010, \eta_p^2 = .041$ , and Reaction,  $F(5, 810) = 62.95, p < .001, \eta_p^2 = .280$ , as well as a significant interaction,  $F(5, 810) = 29.67, p < .001, \eta_p^2 = .155$ . (Means [SEs] for all main and distractor responses are reported in Table S2 in the Supplementary Material.) The effects reported below hold for both men and for women (see Supplementary Material).

Exploring the interaction, first, we replicate findings from Study 1, and we support the prediction that friendship jealousy is more strongly evoked by third-party threats to friendships: People reported greater friendship jealousy in the third-party threat condition ( $M = 3.57, SE = .19$ ) than in the loss alone condition ( $M = 2.60, SE = .21$ ),  $F(1, 162) = 12.09, p = .001, \eta_p^2 = .069, 95\%CI = [0.42, 1.54]$ . See Figure 2a. Providing discriminant evidence, people reported both greater sadness in the loss alone condition ( $M = 5.07, SE = .20$ ) than in the third-party threat condition ( $M = 3.21, SE = .19$ ),  $F(1, 162) = 47.25, p < .001, \eta_p^2 = .226, 95\%CI = [1.32, 2.39]$ , and also greater anger in the loss alone condition ( $M = 3.17, SE = .19$ ) than in the third-party threat condition ( $M = 2.30, SE = .18$ ),  $F(1, 162) = 11.00, p = .001, \eta_p^2 = .064, 95\%CI = [0.35, 1.39]$ . Additionally, people in the third-party threat condition reported greater friendship jealousy than other reactions ( $ps < .030$ ), whereas people in the loss alone condition reported greater sadness than other reactions ( $ps < .001$ ).

**Assessing different types of friend retention.** We conducted a 3 (Condition: control, loss alone, loss to a third party) x 2 [Friend retention tactic: friend guarding–vigilance, everyday friend retention] mixed-factors ANOVA to explore whether condition affected behavioral intentions to engage in these two types of friend retention. This yielded a significant main effect of Friend retention tactic,  $F(1, 235) = 43.50, p < .001, \eta_p^2 = .156$ , and a significant interaction,  $F(2, 235) = 10.28, p < .001, \eta_p^2 = .080$ . The main effect of condition was not significant ( $p = .558$ ). (Means [SEs] for all individual tactics

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are reported in Table S3 in the Supplementary Material available online.)



**Figure 2.** (a) Reported levels of friendship jealousy and related emotions of sadness and anger in reaction to losing a best friendship (alone) versus losing a best friendship to a third party (participants in the control condition did not complete these measures). (b) Reported behavioral intentions to engage in friend guarding–vigilance and everyday friend retention by condition (loss alone, loss to third party, no-information control). Error bars represent standard errors.

Exploring the interaction, we first tested the prediction that people report greater intentions to engage in friend guarding–vigilance when third-party threats to friendships are salient (loss to a third party) than not (control condition). Specifically, we expected—and found—greater intent to engage in friend guarding–vigilance when friendships were threatened by third parties ( $M = 3.97, SE = .20$ ) compared to the control condition ( $M = 3.32, SE = .21$ ),  $F(1, 161) = 4.73, p = .031, \eta_p^2 = .029, 95\%CI = [0.06, 1.24]$ . See Figure 2b. We additionally found a (not-predicted) trend to report greater intent to

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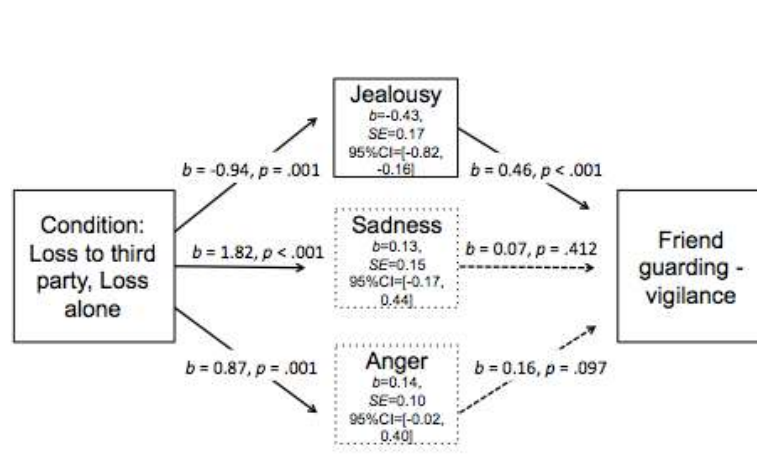
engage in friend guarding–vigilance when friendships were threatened by third parties compared to the loss alone condition ( $M = 3.49$ ,  $SE = .20$ ),  $F(1, 160) = 3.08$ ,  $p = .081$ ,  $\eta_p^2 = .019$ ,  $95\%CI = [-0.06, 1.03]$ . There were no significant differences in reported intent to engage in friend guarding–vigilance between the loss alone and control conditions ( $M = 3.32$ ,  $SE = .22$ ;  $p = .593$ ).

We also find that people reported greater intent to engage in everyday friend retention in the control condition ( $M = 4.63$ ,  $SE = .13$ ) than in the loss to a third party condition ( $M = 4.11$ ,  $SE = .12$ ),  $F(1, 161) = 8.78$ ,  $p = .004$ ,  $\eta_p^2 = .052$ ,  $95\%CI = [0.17, 0.87]$ —or in the loss alone condition ( $M = 4.15$ ,  $SE = .14$ ),  $F(1, 149) = 6.21$ ,  $p = .014$ ,  $\eta_p^2 = .040$ ,  $95\%CI = [0.10, 0.85]$ , though that was not predicted a priori. There were no significant differences in reported everyday friend retention intent between the loss alone and loss to a third party conditions ( $p = .817$ ).

Recall that we did not predict that, when faced with third-party threats, people would report greater intentions to engage in friend-guarding–vigilance than everyday friend retention, as such threats should motivate behavior aimed at each of the central challenges of friend retention (both preventing defection and securing continued investment). We do not find a significant difference between these types of friend retention behavior in the loss to a third party condition ( $p = .435$ ). We did find, in both the control and loss alone conditions, that people reported greater intentions to engage in everyday friend retention behavior than in friend guarding–vigilance,  $F_{control}(1, 235) = 48.10$ ,  $p < .001$ ,  $\eta_p^2 = .170$ ,  $95\%CI = [0.94, 1.68]$ ,  $F_{loss\ alone}(1, 235) = 12.36$ ,  $p < .001$ ,  $\eta_p^2 = .050$ ,  $95\%CI = [0.29, 1.04]$ . Also, as one might expect, this difference was larger in the control than the loss alone condition. This makes some sense; whereas everyday friend retention behavior should be endorsed across conditions, specifically third-party-related friend guarding should be amplified only when third-party threats are salient. Taken together, these findings provide further evidence for the specificity of the behavioral outputs of friendship jealousy—i.e., friend guarding.

**What emotional reactions drive friend guarding?** In our view, third-party threats to valued friendships evoke friendship jealousy, which, in turn, motivates people to engage in friend guarding. (Again, this is not to say that third-party threats and/or friendship jealousy do not also motivate engagement in everyday friend retention tactics; in fact, we would expect this to the extent that these tactics help maintain the friendship by securing friends’ continued investment.) To test this, and thus underscore the predicted specificity of the inputs and outputs of friendship jealousy versus sadness and anger, we performed a parallel multiple mediation analysis (Hayes, 2017). We tested whether the relationship between condition (loss alone, loss to a third party) and intent to engage in friend guarding–vigilance was statically mediated by friendship jealousy, sadness, and/or anger. We used 5,000 bootstrapped iterations to compute a bias corrected 95% confidence interval (CI) for the indirect effects.

As shown in Figure 3, the effect of condition on friend guarding–vigilance was significantly mediated only by reported friendship jealousy,  $b = -0.43$ ,  $SE = 0.17$ ,  $95\%CI = [-0.82 -0.16]$ ; the indirect effects of sadness and anger were not significant, nor was the direct effect,  $b = 0.31$ ,  $SE = 0.30$ ,  $p = .293$ . This supports our prediction that friendship jealousy mediates the effect of condition on reported behavioral intentions to friend guard. Moreover, this finding also mitigates concerns that sadness and/or anger might instead be responsible for driving friend guarding. (See the Supplementary Materials for a similar analysis of everyday friend retention.)



*Figure 3.* Parallel multiple mediation model depicting the effect of condition (loss to a third party, loss alone) on friend guarding-vigilance as mediated by endorsement of reactions (jealousy, sadness, anger).

### **Discussion**

Study 2 supported several key predictions about friendship jealousy and also addressed the concern that emotions other than friendship jealousy might motivate friend guarding. First, we replicated the pattern of responding from Study 1, further suggesting that friendship jealousy (but not sadness and anger) is strongly evoked by third-party threats. Second, this friendship jealousy (but not sadness or anger), in turn, motivated intentions to engage in a tactic of friend guarding (vigilance) thought well-designed to help defend against third-party threats to relationships (e.g., Buss et al., 2008). Findings mitigate concerns that emotions often concomitant with jealousy—sadness and/or anger—might instead motivate friend guarding. Third, we also find that intention to engage in friend guarding–vigilance (behavior that likely functions to mitigate third-party threat to relationships) was greatest in the loss to a third party condition, again consistent with predictions and the overall putative model. (In contrast, intention to engage in everyday friend retention—which likely functions to secure friends’ continued investment in relationships—was greatest in the control condition.)

### **Studies 3a and 3b**

Studies 3a and 3b facilitated three main goals. First, we tested the prediction that friendship jealousy is sensitive to friend value (i.e., closeness), such that the prospective loss of closer friends evokes greater friendship jealousy.

Second, we test between intuitive and functionally-derived predictions as to which cues friendship jealousy is more strongly calibrated—time versus replacement threat. We do so in multiple complementary ways. One way that we do this—in both Studies 3a and 3b—is by varying the type of

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relationship between one's best friend and the potential interloper. Consider two situations wherein a person might be expected to react with jealousy: In one situation their best friend forms a new romantic relationship; in a parallel situation, their best friend forms a new same-sex friendship. A new romantic relationship often makes steep demands on one's time (Dunbar, 2012; Johnson & Leslie, 1982; Milardo et al., 1983; Roberts et al., 2009); presumably, time a best friend spends with a romantic partner cannot also be spent with a friend. Thus, one might intuitively expect a person to feel strong friendship jealousy at a best friend's forming a new romantic relationship—particularly *if such jealousy were driven by the prospective loss of time spent with the best friend* (“time threat”).

However, a person's best friend and romantic partner likely fulfill some distinct functions. Because a new romantic partner is less likely than a new friend to usurp one's place in their best friendship, one will feel less friendship jealousy when their best friend forms a new romantic relationship than a new same-sex friendship—particularly *if such jealousy were driven by the prospective usurpation of one's best friendship* (“replacement threat”). Note also that this functional prediction further distinguishes friendship jealousy from romantic jealousy; that is, one might expect romantic jealousy to be evoked more strongly when interlopers are prospective mates, and friendship jealousy to be evoked more strongly when interlopers are prospective friends.

In sum, we predict that (i) interlopers who are romantic partners evoke less friendship jealousy than those who are same-sex friends. We find support for this prediction in Study 3a, and examine a potential confound linked to those findings in Study 3b: One might wonder whether people's implicit conceptions of a best friend's new romantic relationship—specifically as being short- or long-term in nature—might play a role in lowered friendship jealousy when interlopers are romantic partners (versus same-sex friends). Thus, in Study 3b, we make explicit the type of romantic relationship in which the best friend is engaged. Because long-term partners clearly pose a greater replacement threat than short-

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term partners (e.g., one-night stands), we predict that (ii) long-term partners will evoke greater friendship jealousy than short-term partners. However, we still expect that interlopers who are friends will evoke greater friendship jealousy than will interlopers described as (short- or long-term) romantic partners. Additionally, in Study 3b we extend this by testing the prediction that (iii) *close* friends' new friendships also evoke greater friendship jealousy than do their new romantic relationships.

In Study 3b, we also provide an additional, complementary exploration of whether friendship jealousy is more strongly calibrated to replacement than time threat. Here, we do this by keeping constant the type of relationship but varying the *features* of the interloper; interlopers are either same- or other-sex friends. Because a person's same- and other-sex friends serve some distinct functions (e.g., Bleske & Buss, 2000; Buss & Schmitt, 1993; Lewis et al., 2011), same-sex friends might be perceived to pose greater replacement threats (but not greater or lesser time threats) than other-sex friends. Thus, we predict that (iv) a best friend's new *same-sex* friend will evoke greater friendship jealousy than will a best friend's new *other-sex* friend. This also provides an additional distinction from romantic jealousy; for the majority of people (i.e., heterosexuals), romantic jealousy is evoked by the threat of an other-sex (versus same-sex) rival, whereas friendship jealousy should be more strongly evoked by a same-sex (versus other-sex) rival. Thus, in both Studies 3a and 3b, we test the prediction that interlopers presumably posing greater replacement threats (same-sex friends versus other-sex romantic partners or other-sex friends)—but presumably not greater time threats—evoke greater friendship jealousy.

Popular reporting has highlighted the particular concern that, were one to introduce their best friend to their close friend, those two might hit it off and become closer to one another (e.g., Rosenfeld, 2004). Thus, for ecological validity and for exploratory purposes, we include two types of same-sex interlopers here: a same-sex stranger and a same-sex other who is the participant's own close friend (and who does not have an existing relationship with the focal best friend). Whereas we would still

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predict that either type of same-sex friend will evoke greater friendship jealousy than an other-sex romantic partner, we do not have predictions about the relative levels of friendship jealousy evoked when the interloper is a same-sex stranger versus one's own close friend. On one hand, the anecdotal reporting mentioned above implies that this is a very perturbing situation, and one might speculate that, should the best friend and one's own close friend hit it off and become potentially closer to one another, the actor might be doubly replaced and feel greater friendship jealousy. But on the other hand, research suggests that such network consolidation—as when our previously unacquainted friends become friends with one another—can increase the likely longevity of the focal friendship(s) (Benenson, 2014; Benenson, Nicholson, Waite, Roy, & Simpson, 2001). Thus, the friendship between one's best and one's close friend might decrease concern about losing either friendship and, ultimately, attenuate friendship jealousy.

Third, we again tested the prediction that (v) friendship jealousy positively predicts behavioral intentions to friend guard (in Study 3a). Here, we expand our measurement of friend guarding beyond vigilance by creating a novel friend guarding scale, adapting from mate guarding work (MRI-SF; Buss et al., 2008; Shackelford et al., 2005). The MRI-SF assesses engagement in 19 mate guarding tactics (e.g., monopolization, threaten rivals, derogate mate to rivals). Our friend guarding scale assesses intent to engage in 12 tactics (e.g., vigilance, separation, monopolization) that represent re-conceptualizations and/or combinations of mate-guarding tactics. Whereas we do not have strong predictions about the relative employment of different friend guarding tactics, we do predict that (vi) people will report greater intentions to guard their best friends against interlopers presumably posing greater replacement threats (i.e., those who are friends versus new romantic partners).

### **Method**

#### **Participants.**



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**Study 3a.** Pilot data from a U.S. online community sample suggested that a sample size of 150 participants was suitable to detect significant differences in reported friendship jealousy between focal scenarios (at .80 power for effects  $f \sim .20$ ). Because we also planned to explore our novel friend guarding measure in this study, and would thus need participants to spend a great deal more time on the survey, we recruited into an hour-long survey as many undergraduate participants as possible during a single term, aiming to at least double the sample size used in the pilot. We ultimately recruited 483 individuals who filled out sex information, with 466 individuals (253 female;  $M_{age} = 20.06$ ,  $SD_{age} = 2.04$ ) completing focal measures of a three-part task for course credit. Post-hoc power analysis suggests this gave us power ( $\sim .99$ ) to detect small effects assuming a .5 correlation among measures.

**Study 3b.** Participants ( $N = 303$ ; 125 female;  $M_{age} = 20.44$ ,  $SD_{age} = 1.32$ ) were recruited from an undergraduate pool and participated after first completing an unrelated study on stigma (involving no priming) and a distractor task, with 289 participants (122 female) completing focal dependent variables. The focal task took approximately 20 minutes. Sample size was dictated by power analyses for the unrelated study. Post-hoc analysis reveals this yielded .99 power to detect small effects, assuming .5 correlation between measures.

**Procedure.** In the first part of the task, participants reported basic demographics (age, sex) and a range of information about same-sex friends and friendships. Specifically, participants reported the first name and last initial of same-sex others in their day-to-day lives: a best friend, a close friend who was not already friends with the best friend (close friend #1), a second close friend who was not already friends with the best friend (close friend #2), and an acquaintance. Each relationship type was described (e.g., “A best friend is the ONE person to whom you are closest, a person who would help you in dire times”). Participants were asked, “What is the first

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name and last initial of your SAME-SEX best friend? (If you have a best friend from growing up, but don't see this person on a daily basis, please tell us about your best friend from school or work instead. If you have a same-sex romantic partner you consider your 'best friend' please INSTEAD choose a same-sex best friend in whom you are not sexually interested.)”

Participants also filled out exploratory questions about friendships and about themselves (e.g., fitness interdependence; Aktipis et al., 2018; self-reported closeness, Aron, Aron, & Smollan 1992; self-esteem; Rosenberg, 1965) beyond the scope of the present work.

***Friendship scenarios.*** In the experimental section of the studies, participants were asked to imagine different scenarios regarding friends forming a new, potentially closer relationship with another person. Each scenario used the names of the friends reported in the first part of the task. To give a specific example, participants were instructed: “Imagine that [*Your Acquaintance*] and another same-sex person met up and started to really enjoy one another's company. You haven't previously met this other person, but [*Your Acquaintance*] is spending a lot of time with them. They're becoming fast and close friends—maybe even closer with one another than you are with [*Your Acquaintance*].”

*Study 3a.* In Study 3a, participants imagined and reacted to five scenarios, presented in random order. There were three scenarios with friends of varying closeness (*acquaintance, close friend #1, best friend*) forming a new, potentially closer friendship with a same-sex stranger. These scenarios allowed us to test predictions about friendship jealousy being calibrated to friend value (i.e., closeness).

Two additional scenarios asked participants to imagine the best friend forming new, potentially closer relationships with the participant's own close friend (*close friend #2*), and with a new romantic partner. Along with the scenario in which the best friend forms a new, potentially

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close friendship with a same-sex stranger, these scenarios allowed us to test predictions about friendship jealousy being calibrated to replacement threat, as instantiated via interloper type.

*Study 3b.* Study 3b largely replicated the design of Study 3 with three modifications. The first modification further explored replacement threat by comparing interlopers who were *same-sex* versus *other-sex* new friends (i.e., keeping the type of relationship constant and instead varying replacement threat via features of the interloper). The other two modifications explored the role of replacement threat by further assessing the predicted difference in friendship jealousy toward interlopers who are same-sex friends versus romantic partners. First, participants were also asked to imagine *close friends* forming new, potentially closer romantic relationships (length unspecified). Second, participants were asked to imagine two related, specific scenarios in which the best friend formed a new romantic bond: one in which the best friend formed a new, potentially closer *short-term* romantic relationship (e.g., a one- or few-night stand), and one in which the best friend formed a new, potentially closer *long-term* romantic relationship.

In all, participants imagined seven scenarios. Four involved target individuals forming new, potentially closer same-sex friendships: an acquaintance with a same-sex stranger; a close friend with a same-sex stranger; a best friend with a *same-sex* stranger; a best friend with an *other-sex* stranger. Again, this allows us to test whether friendship jealousy is calibrated to friend closeness. Three involved target individuals forming new, potentially closer romantic relationships—a close friend forming a new, potentially closer romantic relationship; a best friend forming a new, potentially closer romantic relationship with a short-term partner; and a best friend forming a new, potentially closer romantic relationship with a long-term partner. In comparison to other scenarios, these help us test whether friendship jealousy is calibrated to replacement threat (instantiated via relationship type and/or interloper type) versus time threat

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(instantiated via interloper type). Not all possible scenarios in a fully “balanced” design are included (e.g., close friends forming a new, potentially closer friendship with an other-sex stranger); rather, we included only those that replicated or critically extended Study 3a.

**Reported friendship jealousy.** After each scenario, participants reported emotional responses. In Study 3a, responses included jealousy, commonly associated emotions (anger, sadness), and also nine distractor reactions (happy, proud, relieved, dismayed, guilty, resentful, disgusted). In Study 3b, responses assessed included jealousy, anger, sadness and also happiness, fear, and pride. Reactions were assessed on 7-point Likert-scales (1 = *Not at all*, 7 = *Very much*).

**Friend-guarding intentions (Study 3a).** In Study 3a, we assessed behavioral intentions to engage in friend guarding. After completing parts one and two of the experiment, participants were asked to recall three scenarios (the best friend becoming potentially closer with a same-sex stranger, with close friend #2, and with a new romantic partner), in randomized order. After recalling and re-immersing themselves in each scenario, participants filled out a 44-item friend guarding scale (e.g. “How likely would you be to...monopolize your best friend’s time?”;  $\alpha = .97$ ) that we created by adapting the MRI-SF (Buss, Shackelford, & McKibben, 2008; Shackelford, Goetz, & Buss, 2005). Friend-guarding intentions were assessed on a 7-point Likert-scale (1 = *Not at all likely*, 7 = *Very likely*). See Appendix A for all items and tactics.

### Results and Discussion

**Study 3a.** An omnibus test exploring reported friendship jealousy across all scenarios revealed a significant effect of scenario,  $F(4, 1860) = 288.93, p < .001, \eta_p^2 = .383$ .<sup>5</sup> Patterns of

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<sup>5</sup> Given the focus of the current work, and in light of the results of Studies 1 and 2, we discuss at length only findings for friendship jealousy in Studies 3-8b. Means (SEs) for other responses are reported in the Supplementary Material. We assess various emotional responses across

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data were largely the same across participant genders; here, we do see main effects of gender for the first time, such that, compared to men, women reported greater friendship jealousy (see Supplementary Material).

**Study 3b.** We first ran an omnibus test assessing differences in reported friendship jealousy across the seven scenarios,  $F(6, 1728) = 126.11, p < .001, \eta_p^2 = .305$ . Patterns of data were largely the same across participant genders; and we see main effects of gender, with women reporting greater friendship jealousy than men (see Supplementary Material).

**Does friendship jealousy vary as a function of friend value (i.e., closeness)?** Yes. The highest levels of friendship jealousy were evoked in scenarios where new, potentially closer friendships were formed between best friends and strangers, followed by close friends and strangers, followed by acquaintances and strangers.

**Study 3a.** Consistent with predictions, participants reported less friendship jealousy at the prospective loss of acquaintances ( $M = 1.33, SE = .04$ ) than close friends ( $M = 2.27, SE = .08, p < .001, 95\%CI = [-1.09, -.79], \eta_p^2 = .238$ ) or best friends ( $M = 3.47, SE = .09; p < .001, 95\%CI = [-2.34, -1.96], \eta_p^2 = .512$ ), and additionally reported less friendship jealousy at the prospective loss of close friends than best friends ( $p < .001, 95\%CI = [-1.39, -1.03], \eta_p^2 = .271$ ). See Figure 4a.

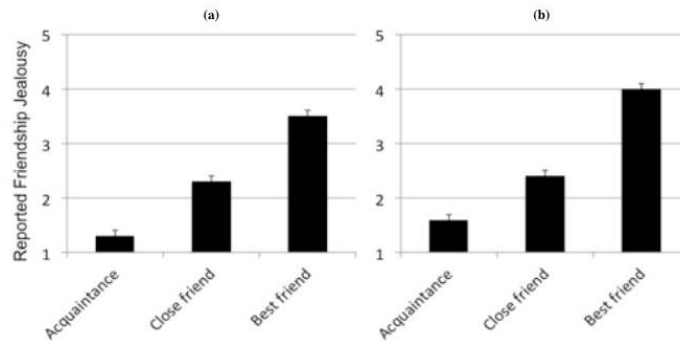
**Study 3b.** Replicating Study 3a, the prospective loss of best friends to same-sex strangers evoked greater reported friendship jealousy ( $M = 3.95, SE = .10$ ) than did the prospective loss of close friends to same-sex strangers ( $M = 2.40, SE = .09, p < .001, 95\%CI = [2.161, 2.628], \eta_p^2 = .414$ ), and the prospective loss of close friends to same-sex strangers evoked greater reported

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studies. In general, most threats to friendship prompt (nuanced patterns of) friendship jealousy and often-concomitant negative emotions, whereas friends forming new romantic relationships additionally prompt some positive responses (e.g., pride, happiness).

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friendship jealousy than did the prospective loss of acquaintances to same-sex strangers ( $M = 1.57$ ,  $SE = .07$ ,  $p < .001$ ,  $95\%CI = [.651, 1.030]$ ,  $\eta_p^2 = .208$ ). See Figure 4b.



**Figure 4.** In both (a) Study 3a and (b) Study 3b, the lowest levels of friendship jealousy were reported when one’s acquaintance became potentially closer with a same-sex stranger, followed by when one’s close friend became potentially closer with a same-sex stranger, and the highest levels were reported when one’s best friend became potentially closer with a same-sex stranger. Error bars reflect standard errors.

**Does friendship jealousy vary as a function of “replacement threat”?** Yes. As predicted, interlopers likely posing a greater replacement threat (but perhaps a lesser time threat; same-sex strangers, participants’ own close friends) evoked greater friendship jealousy than interlopers likely posing a lesser replacement threat (but perhaps a greater time threat; an other-sex romantic partner).

**Study 3a.** People reported significantly lower levels of friendship jealousy at the best friend forming a new romantic relationship ( $M = 2.24$ ,  $SE = .08$ ) versus a new friendship with either a stranger ( $M = 3.47$ ,  $SE = .09$ ,  $p < .001$ ,  $95\%CI = [-1.41, -1.07]$ ,  $\eta_p^2 = .306$ ) or with one’s own close friend ( $M = 4.00$ ,  $SE = .09$ ,  $p < .001$ ,  $95\%CI = [-1.94, -1.58]$ ,  $\eta_p^2 = .439$ ). Although we did not predict this a priori, we also find that people reported greater friendship jealousy when the interloper was their own close

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friend than a same-sex stranger ( $p < .001$ , 95%CI = [0.35, 0.65],  $\eta_p^2 = .130$ ). This suggests that friendship jealousy is more strongly calibrated to replacement than time threat.

**Study 3b.** Extending results from Study 3a, we replicate this pattern of results for the prospective loss of close friends: people reported significantly greater friendship jealousy at the close friend forming a new, potentially closer friendship with a same-sex stranger ( $M = 2.40$ ,  $SE = .09$ ) than a new, potentially closer romantic relationship ( $M = 1.91$ ,  $SE = .08$ ),  $F(1,295) = 32.17$ ,  $p < .001$ , 95%CI = [0.31, 0.64],  $\eta_p^2 = .098$ .

People also reported greater friendship jealousy at the best friend's new friendship with a *same-sex* stranger ( $M = 3.95$ ,  $SE = .10$ ) than an *other-sex* stranger ( $M = 2.79$ ,  $SE = .10$ ),  $F(1, 289) = 135.22$   $p < .001$ , 95%CI = [0.96, 1.35],  $\eta_p^2 = .312$ ). This further suggests that friendship jealousy is strongly calibrated to replacement threat (which is presumably greater for new same- than other-sex friends) and not necessarily time threat (which is presumably equal for new same- and other-sex friends). See Figure 5a.

Again replicating and extending results from Study 3a, people reported greater friendship jealousy at best friends' new friendships with same-sex strangers ( $M = 3.95$ ,  $SE = .10$ ) than either best friends' new short-term romantic relationships ( $M = 2.04$ ,  $SE = .08$ ),  $F(1,297) = 240.19$   $p < .001$ , 95%CI = [1.67, 2.16],  $\eta_p^2 = .447$ , or long-term romantic relationships ( $M = 2.27$ ,  $SE = .09$ ),  $F(1, 297) = 260.40$   $p < .001$ , 95%CI = [1.50, 1.92],  $\eta_p^2 = .467$ . People reported greater friendship jealousy at the best friend's forming a new long- versus short-term romantic relationship,  $F(1,298) = 6.62$   $p = .011$ , 95%CI = [0.05, 0.37],  $\eta_p^2 = .022$ ).

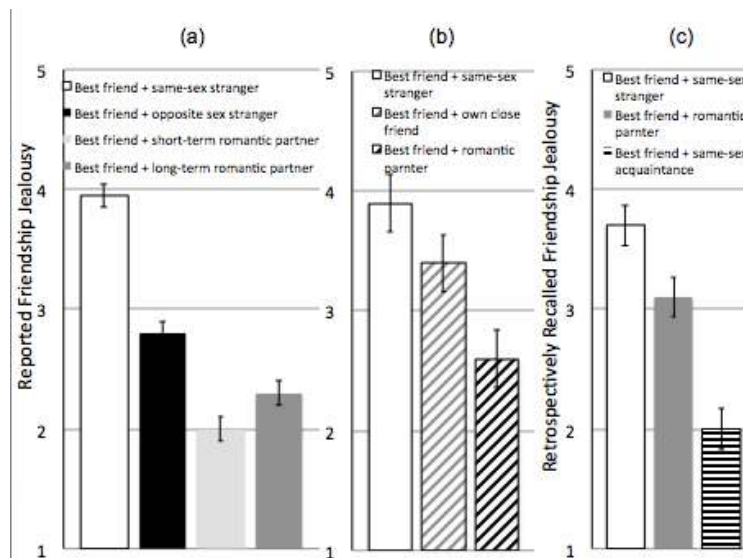
### **Friend-guarding intentions (Study 3a).**

***Does friendship jealousy positively predict behavioral intentions to friend guard?*** We first created a *best friend jealousy* composite, consisting of participants' reported jealousy in

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reaction to each scenario wherein best friends formed new, close bonds they can later guard against (same-sex strangers, own close friends, romantic partners;  $\alpha = .77$ ), and a *best friend friend-guarding intentions* composite, consisting of reported behavioral intentions to friend guard in reaction to each of these scenarios ( $\alpha = .99$ ). Consistent with predictions, this aggregated measure of best friendship jealousy was significantly, positively, and strongly associated with reported intent to guard best friends,  $r(468) = .527, p < .001$ . We note, however, as we discuss below, that intentions to friend guard are low (but see Studies 2, 5b, 6, 8a, and 8b).

We also conducted other tests supporting the notion that friendship jealousy predicts friend guarding, even over and above sadness and anger (see Supplementary Materials). For both genders, friendship jealousy strongly and positively predicts intentions to friend guard, and friend-guarding intentions vary in line with predictions (see Supplementary Materials).



**Figure 5.** Reported friendship jealousy in reaction to multiple scenarios in which same-sex best friends form new, potentially closer relationships with third parties from (a) Study 3b and (b) Study 4, and (c) retrospectively recalled friendship jealousy in reaction to multiple lived



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experiences when best friends formed close same-sex friendships, close romantic relationships, or same-sex acquaintanceships (from Study 5). Error bars represent standard errors.

***Do friend-guarding intentions vary in accordance with predictions?*** Yes. We conducted a 3 [Interloper] x 12 [Tactic] repeated measures ANOVA, which yielded main effects of interloper,  $F(2,924) = 91.34, p < .001, \eta_p^2 = .165$ , and tactic,  $F(11, 5082) = 141.56, p < .001, \eta_p^2 = .235$ , as well as an interloper x tactic interaction,  $F(22, 10164) = 16.15, p < .001, \eta_p^2 = .034$ .

First, aggregating over the 12 tactics, as predicted, people reported significantly greater intentions to guard against interlopers who were same-sex strangers ( $M = 1.88, SE = .05$ ) than romantic partners ( $M = 1.50, SE = .03$ ),  $F(1, 462) = 139.57, p < .001, \eta_p^2 = .232, 95\%CI = [0.32, 0.44]$ . Similarly, people reported significantly greater intentions to guard against interlopers who were their own close friends than romantic partners,  $F(1, 462) = 72.77, p < .001, \eta_p^2 = .136, 95\%CI = [0.18, 0.28]$ . Additionally, people reported greater intention to friend guard when interlopers were same-sex strangers than their own close friends ( $M = 1.73, SE = .04$ ),  $F(1, 465) = 36.10, p < .001, \eta_p^2 = .072, 95\%CI = [0.10, 0.20]$ .

Second, exploring the interaction reveals that this overall pattern largely holds across tactics of friend guarding (Table 1). In general, different rivals cause people to report different levels of friend-guarding intent; and these intentions are greatest in response to rivals best positioned to usurp one's friendship (i.e., same-sex rivals as compared to romantic partners).

Table 1  
Intentions to engage in 12 friend-guarding tactics ( $M, SE$ ) across types of rivals

Tactic	Rivals		
	Same-sex stranger	Own close friend	Romantic partner
Vigilance	2.18 (.07)	2.07 (.07)	1.83 (.06)
Separation	2.06 (.06)	1.87 (.06)	1.45 (.04)
Monopolization	1.99 (.07)	1.80 (.06)	1.40 (.04)
Induce Jealousy	2.00 (.06)	1.91 (.07)	1.52 (.05)

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Punish/Threaten Friend	1.58 (.04) <sup>*</sup> <sub>[own friend]</sub>	1.53 (.04) <sup>*</sup> <sub>[stranger]</sub>	1.34 (.04)
Emotional Manipulation	1.77 (.05)	1.68 (.05)	1.44 (.04)
Derogate Rival	1.65 (.05)	1.38 (.04)	1.32 (.03)
Self/Commitment Enhancement	2.48 (.06)	2.35 (.06)	2.00 (.06)
Possession Signals	2.41 (.08)	2.22 (.07) <sup>*</sup> <sub>[partner]</sub>	1.99 (.07) <sup>*</sup> <sub>[own friend]</sub>
Derogation of Own Friend	1.35 (.05) <sup>*</sup> <sub>[own friend]</sub>	1.29 (.03) <sup>*</sup> <sub>[stranger]</sub>	1.21 (.04)
Direct Aggression toward Rival	1.32 (.04)	1.27 (.03)	1.19 (.03)
Indirect Aggression toward Rival	1.77 (.05)	1.39 (.04)	1.32 (.04)

All means in each row are significantly different from one another unless denoted by \* ( $p < .06$ )

Marginally significant<sub>[comparison group]</sub> or \*\* ( $p > .150$ ) Not significant<sub>[comparison group]</sub>

***Does friendship jealousy statistically mediate the relationship between presumed replacement threat (instantiated via rival type) and friend-guarding intentions?*** Yes. Recall that, here, presumed replacement threat is instantiated via rival type. Because we reason that new friends pose greater replacement threats than do new romantic partners, we predict that best friends forming new *friendships* versus new *romantic relationships* would evoke greater friendship jealousy, and, in turn, increased intentions to friend guard. Specifically, then, a same-sex stranger—and perhaps also the participant’s own close friend—should evoke greater replacement threat than romantic partners, and thus, we expect friend-interlopers to evoke greater friendship jealousy and, in turn, friend guarding, than the romantic-interlopers. Again, however, we note equivocal intuitions about the comparison between interlopers who are same-sex strangers versus participants’ own close friends: on one hand, the pairing of one’s best and one’s close friends might evoke even more friendship jealousy than the pairing of one’s best friend and a stranger (e.g., Rosenfeld, 2004); on the other hand, this relationship might attenuate friendship jealousy relative to a same-sex stranger (e.g., Benenson et al., 2001).

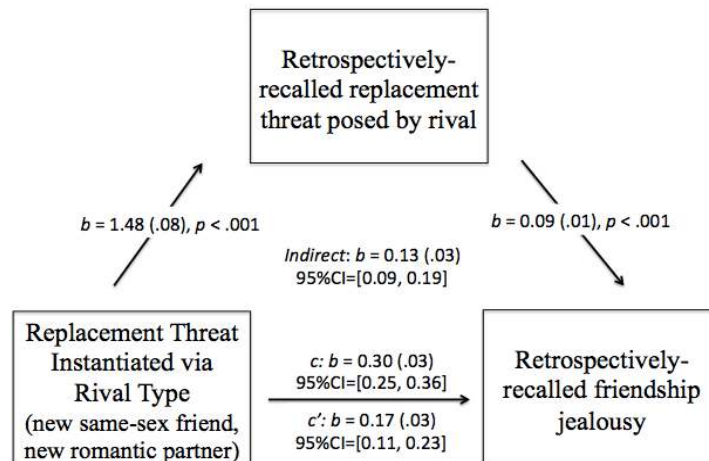
Given this, we conduct tests of statistical mediation two ways. First, we aggregate across *both* same-sex friend-interlopers—same-sex strangers and participants’ own close friends—in computing friendship jealousy and friend guarding, comparing these aggregates against scores in

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response to romantic-interlopers. Second, we compare only same-sex friend-interlopers against romantic-interlopers. Both tests yield the same pattern of results, supporting predictions. (See the Supplementary Materials for the latter test). To explore this—and thus our model for friendship jealousy (see Figure 6)—we used MEMORE, an SPSS macro for conducting mediation analyses on within-subjects variables (Montoya & Hayes, 2017). We replicate the results reported below for the predicted mediation (but not for parallel multiple mediation) when examining only women or only men (see Supplemental Materials).

To compare friendship jealousy and friend guarding in reaction to *friendships* versus *romantic relationships*, we aggregated reported friendship jealousy when best friends formed new, potentially closer friendships (i.e., with same-sex strangers and with participants' own close friends;  $\alpha = .79$ ) and we similarly aggregated reported friend guarding for friendships (i.e., when interlopers were same-sex strangers and participants' own close friends;  $\alpha = .98$ ). We then entered the two measures of reported friendship jealousy—when best friends form new friendships (aggregated) versus new romantic relationships—as mediators of the relationship between rival type and friend-guarding intentions using 5,000 bootstrapped iterations to compute a bias corrected 95% CI for the indirect effects. This yielded a significant indirect effect ( $b = .13$ ,  $SE = 0.03$ ; 95%CI=[0.09, 0.19]), suggesting that, as predicted, greater friendship jealousy is evoked when interlopers are friends versus romantic partners, and, in turn, this friendship jealousy motivates greater behavioral intentions to guard the best friendship. The direct effect remained significant,  $b = .17$ ,  $SE = 0.03$ ,  $p < .001$ , 95%CI = [0.11, 0.23]. See Figure 6.

Parallel multiple mediation analysis further suggests that friendship jealousy—but not sadness and anger—predicts friend-guarding intentions (see Supplementary Materials).



**Figure 6.** Proposed statistical mediation model showing that reported friendship jealousy statistically mediates the relationship between replacement threat, instantiated via interloper type (same-sex friends, other-sex romantic partner), and intentions to engage in friend guarding.

### Study 4

Study 4 facilitated two main goals. First, we again test the prediction that friendship jealousy is more sensitive to replacement threat than time threat (by varying interloper type). Second, and importantly extending Studies 3a and 3b, we test these predictions in a between-subjects manner. Participants report their reactions to one of four hypothetical scenarios: same-sex best friends becoming potentially closer with a same-sex stranger, same-sex best friends becoming potentially closer with the participant’s existing close friend (who was not previously friends with the focal best friend), same-sex best friends becoming potentially closer with a romantic partner, or participants’ own *romantic partners* becoming potentially closer to an other-sex stranger (i.e., a mate poacher). (Although our theory does not make predictions about romantic jealousy, one might understandably wonder how levels of reported friendship jealousy and better-studied romantic jealousy compare to one another, thus we also explore people’s reported romantic jealousy in response to the threatened loss of their romantic partners.)

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Conducting this study between-subjects mitigates concerns that the within-subjects designs of Studies 3a and 3b elicited implicit and/or explicit comparisons, and were thus problematic for testing our predictions. One might also find the between-subjects design to be more ecologically valid.

### **Method**

**Participants.** We determined a sample size of approximately 350 participants was necessary for .80 power to detect small effects ( $f = .15$ ) in specifically friendship jealousy between conditions. We recruited 384 US participants from TurkPrime who participated in an approximately seven-minute survey for small monetary compensation; of those, 268 participants (139 female) passed two attention checks, reported sex information, and completed focal measures. This yields .80 power to detect small to medium effects ( $f = .17$ ).

**Procedure and design.** Similar to previous studies, participants first filled out brief demographic information and filled in names of same-sex others, including best friends. Participants were then randomly assigned to read and respond to one of four hypothetical scenarios about: best friends becoming potentially closer to a same-sex stranger, best friends becoming potentially closer to the participant's own same-sex close friend (whom the best friend did not previously know), best friends becoming potentially closer to an other-sex romantic partner, romantic partners becoming potentially closer to a person of the same sex as the participant. Unlike previous studies, participants in the condition wherein best friends form new romantic relationships were first instructed to imagine that their best friends were not currently in a romantic relationship. Participants reported their reactions—jealousy, often-concomitant emotions of sadness and anger, and distractor emotions (pity, fear, pride)—on a 7-point Likert scale (1 = *Not at all*, 7 = *Very much*).

### **Results and Discussion**

**Does jealousy vary as a function of replacement threat?** Yes; we replicate results from

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Studies 3a and 3b, which had within-subjects designs, here using a between-subjects design (and an adult community sample). Effects did not vary by participant gender (see Supplementary Material).

An omnibus test assessing reported jealousy across the four scenarios yielded a significant effect of scenario,  $F(3, 209) = 20.88, p < .001, \eta_p^2 = .231$ . Consistent with predictions, both instances when interlopers were same-sex friends evoked greater reported friendship jealousy (same-sex stranger:  $M = 3.91, SE = 0.24$ ; same-sex own close friend  $M = 3.43, SE = 0.25$ ) than when the interloper was an other-sex romantic partner ( $M = 2.64, SE = 0.24$ ),  $F_{stranger}(1, 109) = 14.39, p < .001, \eta_p^2 = .117, 95\%CI = [0.62, 1.93]$  and  $F_{closefriend}(1, 104) = 5.59, p = .020, \eta_p^2 = .051, 95\%CI = [0.12, 1.47]$ . There was no significant difference in reported friendship jealousy when interlopers were same-sex friends ( $p = .116$ ). See Figure 5b. This suggests that the within-subjects aspect of previous studies was not solely responsible for the predicted pattern of findings, and thus mitigates the possible concern that our pattern of findings was due to a within-subjects design that may have elicited implicit and/or explicit comparisons.

We also find that people reported significantly greater jealousy in scenarios where their romantic relationships were threatened ( $M = 5.28, SE = 0.25$ ) than in those where their best friendships were threatened,  $F_{stranger}(1, 105) = 15.67, p < .001, \eta_p^2 = .130, 95\%CI = [2.05, 0.68]$ ,  $F_{closefriend}(1, 100) = 28.62, p < .001, \eta_p^2 = .223, 95\%CI = [1.16, 2.53]$ ,  $F_{romanticpartner}(1, 104) = 68.19, p < .001, \eta_p^2 = .396, 95\%CI = [2.01, 3.27]$ . This is consistent with notions that, even as both romantic and friendly affections might be genuinely finite, exclusivity norms about these relationship types—and specifically relatively greater exclusivity norms for romantic relationships—affect responding (e.g., Davis & Todd, 1982).

### Studies 5a and 5b

The majority of jealousy research examines reactions to hypothetical scenarios (e.g., Buss, 2013; Daly et al., 1982; DeSteno & Salovey, 1996; Parker et al., 2005, 2010), as did Studies 1-4. One might wonder, however, whether people are able to accurately assess and report

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how they would feel in such situations; after all, people are thought to be poor affective forecasters (e.g., Wilson & Gilbert, 2005). To complement the findings above, and to address the concern that findings from Studies 1-4 might be driven solely by errors in affective forecasting, Studies 5a and 5b asked participants to *recall* various times when same-sex best friends became close with new same-sex friends, with romantic partners, and/or formed new same-sex acquaintanceships. To do this, we adapted methods from the well-established Relived Emotion Task (Ekman, Levenson, & Friesen, 1983)—here asking participants to recall rather than relive real-world experiences. Although less controlled than hypothetical scenarios, this provides a complementary and perhaps more ecologically-valid means for exploring friendship jealousy.

Additionally, Studies 5a and 5b provide an empirical test of our previous assumption that friends are perceived to pose greater replacement threats (but lesser time threats) than romantic partners, and vice versa. Here, participants gave retrospective reports of how much each interloper threatened to “replace” them in their friendships, as well as how much time the best friend spent with this new person (when the participant was not also included). Studies 5a and 5b thus also allow us to empirically test whether replacement and/or time threat statistically mediates the relationship between interloper type and friendship jealousy.

Study 5b also further explores both friend-guarding behavior and subsequent friend retention. Whereas theory and evidence thus far provide some support for the prediction that friendship jealousy (but not sadness or anger) motivates behavior aimed at countering threats that evoked it, here, we are able to begin to assess the related question of whether friend guarding is actually efficacious in countering those threats.

In all, participants reported the likelihood that each bond—the best friend’s same-sex friend, the best friend’s romantic partner, the best friend’s same-sex acquaintance—posed a

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replacement threat and a time threat, and reported the amount of friendship jealousy they felt at the time the event occurred. In Study 5b, participants then also reported the extent to which they engaged in several tactics of friend guarding at the time and whether they successfully retained their best friendships. To overview our specific predictions, we expect that (i) people will recall having experienced greater friendship jealousy when rivals were friends than romantic partners (or acquaintances). We predict that (ii) same-sex friends were perceived as having posed a greater replacement threat than romantic partners (or acquaintances), but that (iii) romantic partners were perceived as having posed a greater time threat than same-sex friends (or acquaintances). This perceived replacement threat (but not time threat) should mediate the relationship between interloper type and friendship jealousy. We also expect that (iv) people will report more friend guarding when rivals were friends than romantic partners (or acquaintances), and that (v) friendship jealousy mediates the relationship between interloper type and friend guarding. Finally, we explore friend retention rates across rival types, and we test whether friend guarding is perhaps positively associated with friend retention today (i.e., may be efficacious).

### **Method**

#### **Participants.**

**Study 5a.** We determined a sample size of approximately 160 participants was necessary to detect small effects ( $f = .15$ ) in friendship jealousy between rival types (with .99 power, and measurement correlation = .05). We recruited 212 U.S. participants from TurkPrime who participated in an approximately 12-minute study in return for small monetary compensation. Of these, 183 participants (99 females, 2 other;  $M_{age} = 38.12$ ;  $SD_{age} = 11.93$ ) filled out focal dependent variables, reported their biological sexes, and were determined to be genuine (i.e., not



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bots) based on answers to open-ended questions and reported experiencing at least one of the friendship events.

**Study 5b.** Following analyses from Study 5a, we attempted to recruit the same number of usable participants (~180). Participants were recruited from Turk Prime into an approximately 15-minute study in return for small monetary compensation. Of the 278 U.S. participants (156 female, 1 no sex reported) who began the survey, 249 participants (144 female,  $M_{age} = 37.50$ ,  $SD_{age} = 11.88$ ) were determined to be genuine (i.e., not bots) based on answers to open-ended questions and also responded as having experienced at least one of the friendship events.

**Procedure.** We adapted the well-established Relived Emotion Task (Ekman et al., 1983). Participants were asked questions about their same-sex best friendships across their lifetimes, and were given the same description of a best friend as in previous experiments. Participants were asked to recall if one or more of three unique events occurred: (1) best friends becoming newly close with a same-sex person (i.e., a friend), (2) best friends forming new close romantic relationships, and (3) best friends making new same-sex acquaintanceships.

All text in prompts was the same between Studies 5a and 5b, with one exception—in Study 5b, we noted that the same-sex friendships could have been *newly* close; that is, the new friend did not have to be a new person and/or same-sex stranger *per se* (e.g., that rival could have been an existing friend with whom the best friend simply became newly close). To ensure that best friends' new friendships and romantic relationships were at least similarly close in quality—echoing the controlled hypothetical scenarios from previous studies—we added text in the two prompts asking participants to recall events when, for example, a best friend formed a new [romantic relationship] during the time that they were friends—“in particular a new [romantic relationship] that may have been just as close as your friendship with your best friend was.”

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We included acquaintanceships only to assess whether the pattern of responding seen toward hypothetical scenarios from previous studies replicated via this complementary paradigm; we did not anticipate this instance to be associated with much friendship jealousy.

Participants were also instructed that, should any event have occurred more than once, they should think about the event that was the most meaningful and salient for them *at the time*. Participants reported whether each event happened, maybe happened, or did not happen. For each event that participants recalled as having happened or as maybe having happened, participants answered questions about that event. The order in which questions about each of the three events appeared was randomized.

***Retrospective replacement threat.*** Participants responded to two items assessing the extent to which rivals threatened to replace them (“How much did your best friend's [new romantic partner] threaten to ‘take your place’ in your best friend's affections?”; How much did your best friend’s [new romantic partner] threaten to fulfill the same functions for your best friend that you were currently fulfilling?”;  $\alpha = .89 - .92$ ) on 8-point bipolar scales (1 = *Not at all*, 8 = *Very much*). In Study 5a, participants responded to only the first of these two items.

***Retrospective time threat.*** Participants reported the extent to which rivals took up the best friend’s time (“How much time did your best friend spend with this [new romantic partner] (without you there)?”) on an 8-point bipolar scale (1 = *Not at all*, 8 = *Very much*).

***Retrospective friendship jealousy.*** Participants were asked “At the time that it happened to you—that your best friend formed a new [romantic relationship]—to what extent did you feel...?” Participants reported their reactions, including friendship jealousy, anger, sadness, and also two distractor emotional reactions (happiness, pride) on a 7-point Likert-scale (1 = *Not at all*, 7 = *Very much*).

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**Retrospective friend-guarding behavior (Study 5b).** In Study 5b, participants were also asked, “At the time that it happened to you—that your best friend formed a new [romantic relationship]—to what extent did you engage in each of the following behaviors?” We assessed the five friend-guarding tactics that received the greatest endorsement in Study 3a (*Vigilance* [ $\alpha = .94$ ], *Separation* [ $\alpha = .92$ ], *Induce Jealousy* [ $\alpha = .92$ ], *Self/Commitment Enhancement* [ $\alpha = .92$ ], *Possession Signals* [ $\alpha = .92$ ]) via the same items as used in Study 3a (overall  $\alpha = .97$ ).

**Successful retention (Study 5b)?** In Study 5b, participants were also asked “At the time that it happened to you—that your best friend formed a new [romantic relationship]—did you successfully maintain a relationship with your best friend that was the same or highly similar in quality?”, and responded either “No” or “Yes.”

### Results

**Study 5a.** Of 182 participants, 142 (82 female) reported that, during the focal best friendships, their best friends formed (or maybe formed) new, close friendships with same-sex strangers, 152 (86 female) reported that their best friends formed (or maybe formed) new, close romantic relationships, and 161 (92 female) reported that their best friends formed (or maybe formed) new same-sex acquaintanceships. Patterns of data are the same across participant genders (see Supplementary Material).

**Study 5b.** Of 249 participants, 197 (114 female) reported that their best friends formed (or maybe formed) close friendships with same-sex friends, 208 (125 female) reported that their best friends formed (or maybe formed) close romantic relationships, and 211 (124 female) reported that their best friends formed (or maybe formed) new same-sex acquaintanceships. Patterns of data were largely the same across participant genders (see Supplementary Material).

### Retrospective replacement threat.

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**Study 5a.** An ANOVA exploring differences in replacement threat recalled by participants across rival types yielded a significant effect,  $F(2, 232) = 31.44, p < .001, \eta_p^2 = .213$ . Participants recalled greater replacement threat when rivals were same-sex strangers ( $M = 4.68, SE = .21$ ) than when rivals were romantic partners ( $M = 4.23, SE = .21; p = .023, 95\%CI=[0.06, 0.84], \eta_p^2 = .038$ ) or same-sex acquaintances ( $M = 3.08, SE = .20; p < .001, 95\%CI=[1.18, 2.03], \eta_p^2 = .328$ ). Participants also recalled greater replacement threat when rivals were romantic partners than same-sex acquaintances ( $p < .001, 95\%CI=[0.73, 1.58], \eta_p^2 = .195$ ).

**Study 5b.** An ANOVA exploring possible differences in replacement threat yielded a significant effect of rival type,  $F(2, 338) = 50.33, p < .001, \eta_p^2 = .229$ . Replicating findings from Study 5a, when rivals were same-sex friends, participants recalled greater replacement threat ( $M = 4.90, SE = .16$ ) than when rivals were romantic partners ( $M = 4.45, SE = .18; p = .010, 95\%CI=[.10, .76], \eta_p^2 = .030$ ) or same-sex acquaintances ( $M = 3.30, SE = .16; p < .001, 95\%CI=[1.26, 1.89], \eta_p^2 = .329$ ). Participants also recalled greater replacement threat when rivals were romantic partners than same-sex acquaintances ( $p < .001, 95\%CI=[.82, 1.47], \eta_p^2 = .230$ ). Findings suggest that interlopers are perceived as posing greater replacement threats when they are new close friends as compared to romantic partners (or acquaintances).

### **Retrospective time threat.**

**Study 5a.** An ANOVA exploring possible differences in time threat recalled by participants across rival types yielded a significant effect,  $F(2, 228) = 37.39, p < .001, \eta_p^2 = .247$ . As expected, participants recalled greater time threat when rivals were romantic partners ( $M = 5.36, SE = .21$ ) than same-sex strangers ( $M = 4.01, SE = .15; p < .001, 95\%CI=[0.84, 1.86], \eta_p^2 = .177$ ) or same-sex acquaintances ( $M = 3.16, SE = .19; p < .001, 95\%CI=[1.65, 2.76], \eta_p^2 = .397$ ).

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Participants also recalled greater time threat when rivals were same-sex strangers than same-sex acquaintances ( $p < .001$ , 95%CI=[0.40, 1.31],  $\eta_p^2 = .111$ ).

**Study 5b.** An ANOVA exploring possible differences in time threat also yielded a significant effect of rival type,  $F(2, 338) = 103.14$ ,  $p < .001$ ,  $\eta_p^2 = .379$ . Replicating findings from Study 5a, participants recalled greater time threat when rivals were romantic partners ( $M = 6.28$ ,  $SE = .13$ ) than same-sex friends ( $M = 5.35$ ,  $SE = .12$ ;  $p < .001$ , 95%CI=[.66, 1.21],  $\eta_p^2 = .210$ ) or acquaintances ( $M = 4.07$ ,  $SE = .14$ ;  $p < .001$ , 95%CI=[1.87, 2.57],  $\eta_p^2 = .414$ ).

Participants also recalled greater replacement threat when rivals were same-sex friends than same-sex acquaintances ( $p < .001$ , 95%CI=[.99, 1.58],  $\eta_p^2 = .231$ ). Findings support the previous assumption that interlopers are perceived as posing greater time threats when they are new romantic partners as compared to close friends (or acquaintances).

### **Retrospective friendship jealousy.**

**Study 5a.** Echoing the pattern above for replacement threat (but not time threat), an ANOVA exploring participants' recalled friendship jealousy yielded a significant effect of rival type,  $F(2, 230) = 50.03$ ,  $p < .001$ ,  $\eta_p^2 = .303$ ; participants recalled experiencing greater friendship jealousy when rivals were same-sex strangers ( $M = 3.72$ ,  $SE = .18$ ) than romantic partners ( $M = 3.09$ ,  $SE = .18$ ;  $p < .001$ , 95%CI=[0.30, .96],  $\eta_p^2 = .111$ ) or same-sex acquaintances ( $M = 2.03$ ,  $SE = .15$ ;  $p < .001$ , 95%CI=[1.35, 2.11],  $\eta_p^2 = .474$ ). Participants also recalled greater friendship jealousy when rivals were romantic partners than same-sex acquaintances ( $p < .001$ , 95%CI=[0.70, 1.40],  $\eta_p^2 = .179$ ). See Figure 5c (above).

**Study 5b.** Replicating findings from Study 5a, and also echoing the pattern above for replacement threat (but not time threat), an ANOVA exploring possible differences in recalled friendship jealousy yielded a significant effect of rival type,  $F(2, 332) = 45.11$ ,  $p < .001$ ,  $\eta_p^2 =$

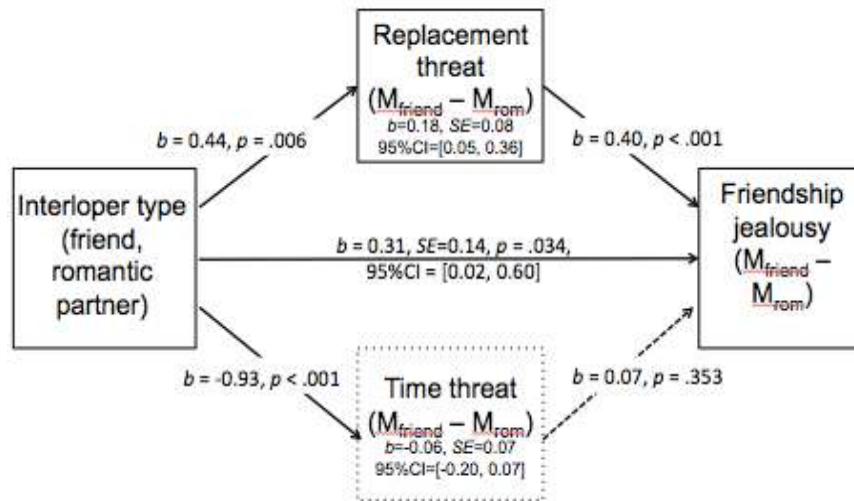
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.214. When rivals were same-sex friends, participants recalled greater friendship jealousy ( $M = 3.73$ ,  $SE = .15$ ) than when rivals were romantic partners ( $M = 3.30$ ,  $SE = .15$ ;  $p < .001$ ,  $95\%CI = [.14, .73]$ ,  $\eta_p^2 = .048$ ) or same-sex acquaintances ( $M = 2.40$ ,  $SE = .13$ ;  $p < .001$ ,  $95\%CI = [1.04, 1.63]$ ,  $\eta_p^2 = .294$ ). Participants also recalled greater friendship jealousy when rivals were romantic partners than same-sex acquaintances ( $p < .001$ ,  $95\%CI = [.65, 1.16]$ ,  $\eta_p^2 = .177$ ). (When examining men and women separately, men reported equal jealousy when interlopers were same-sex strangers and romantic partners; see Supplementary Material.)

**Does replacement threat (or time threat) drive friendship jealousy?** We test this using MEMORE, an SPSS macro for conducting mediation analyses on within-subjects variables (Montoya & Hayes, 2017). We conducted parallel multiple mediation of the influence of replacement and time threats on friendship jealousy, using 5,000 bootstrapped iterations to compute a bias corrected 95% CI for the indirect effects. When separating the sample by participant gender, we replicate effects among only women (see Supplementary Materials.)

**Study 5a.** Consistent with predictions, the indirect effect of interloper type on friendship jealousy was significantly mediated by replacement threat,  $b = 0.18$ ,  $SE = 0.09$ ,  $95\%CI = [0.03, 0.39]$ , but not by time threat,  $b = -0.02$ ,  $SE = 0.09$ ,  $95\%CI = [-0.22, 0.14]$ . The direct effect was significant,  $b = 0.48$ ,  $SE = 0.16$ ,  $p = .004$ ,  $95\%CI = [0.15, 0.81]$ .

**Study 5b.** As shown in Figure 7—and replicating Study 5a—the indirect effect of interloper type on friendship jealousy was significantly mediated by replacement threat,  $b = 0.18$ ,  $SE = 0.08$ ,  $95\%CI = [0.05, 0.36]$ , but not by time threat,  $b = -0.06$ ,  $SE = 0.07$ ,  $95\%CI = [-0.20, 0.07]$ . The direct effect was significant,  $b = 0.31$ ,  $SE = 0.15$ ,  $p = .034$ ,  $95\%CI = [0.02, 0.60]$ .



**Figure 7.** Parallel multiple mediation models depicting the effect of interloper type on friendship jealousy as mediated by replacement and time threats from Study 5b.

**Retrospective friend-guarding behavior.** In Study 5b, we ran a 3 [Rival type] x 5 [Friend-guarding tactic] mixed-factors ANOVA to explore recalled friend guarding. This yielded significant effects of rival type,  $F(2, 290) = 163.55, p < .001, \eta_p^2 = .530$ , and tactic,  $F(4, 580) = 35.81, p < .001, \eta_p^2 = .198$ , and a significant interaction,  $F(8, 1160) = 32.20, p < .001, \eta_p^2 = .182$ .

First, aggregating over tactics, we find that people reported greater friend-guarding behavior toward rivals who were same-sex friends ( $M = 3.01, SE = .11$ ) than romantic partners ( $M = 2.53, SE = .11; p < .001, 95\%CI=[0.38, 0.59], \eta_p^2 = .359$ ) or same-sex acquaintances ( $M = 2.09, SE = .11; p < .001, 95\%CI=[0.82, 1.03], \eta_p^2 = .684$ ). Participants also reported greater friend-guarding behavior when rivals were romantic partners than same-sex acquaintances ( $p < .001, 95\%CI=[0.35, 0.54], \eta_p^2 = .356$ ). Second, people recalled employing four out the five friend-guarding tactics more (a) when rivals were same-sex friends than when rivals were romantic partners or same-sex acquaintances ( $ps < .005$ ) and also (b) when rivals were romantic partners than when rivals were acquaintances ( $ps < .005$ ). The exception was Inducing Jealousy,

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which people recalled having deployed more when rivals were romantic partners than same-sex friends ( $p \leq .001$ ). See Table 2 for all means (SEs).

Table 2  
Means (SEs) for friend-guarding behavioral tactics employed toward different rivals

<u>Tactic</u>	<u>Same-sex friend</u>	<u>Romantic partner</u>	<u>Same-sex acquaintance</u>
Vigilance ( $\alpha = .89$ )	3.35 (.14)	2.37 (.13)	2.08 (.13)
Separation ( $\alpha = .94$ )	2.57 (.13)	2.23 (.12)	1.93 (.11)
Inducing Jealousy ( $\alpha = .91$ )	2.25 (.12)	2.17 (.12)	1.98 (.13)
Self/Commitment Enhancement ( $\alpha = .92$ )	3.56 (.12)	2.88 (.12)	2.24 (.12)
Possession Displays ( $\alpha = .92$ )	3.34 (.13)	2.64 (.12)	2.20 (.12)

*Note* All comparisons between rival types were significant ( $p \leq .005$ ).

**Does friendship jealousy drive friend guarding?** Yes. A primary prediction was that best friends' friendships evoke greater friendship jealousy than their romantic relationships, and that these differences in friendship jealousy, in turn, motivate differences in friend-guarding behavior. We used 5,000 bootstrapped iterations to compute a bias corrected 95% CI for the indirect effects to test this. The analysis yielded a significant indirect effect of friendship jealousy,  $b = 0.04$ ,  $SE = 0.02$ ,  $95\%CI=[0.01, 0.10]$ , supporting the proposed model. The direct effect was significant,  $b = 0.43$ ,  $SE = 0.05$ ,  $p < .001$ ,  $95\%CI=[0.33, 0.53]$ . (This effect held for women but not men when examining the genders separately. See Supplementary Materials.)

**How often did people retain best friendships across interloper type?** Of participants responding to each prompt, 90.6% (valid percent) reported successfully retaining best friends against same-sex acquaintances, 41.6% (valid percent) reported successfully retaining best friends against same-sex rivals, and 47.4% (valid percent) reported successfully retaining best friends against romantic partners. To our knowledge, this provides some of the first evidence on actual friend retention in the face of third-party threats to friendships.



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Using a McNemar test, we find that people reported retaining best friendships more often when rivals were acquaintances than same-sex friends ( $p < .001$  for 156 cases) or romantic partners ( $p < .001$  for 161 cases), as one might expect if acquaintances pose less replacement threat than other potential interlopers. There were no differences in reported retention when rivals were same-sex friends versus romantic partners ( $p = .282$  for 156 cases). Patterns of data—but not significance levels—are largely the same when examining men and women separately (see Supplementary Materials).

**Is more friend guarding associated with greater friend retention?** We explored whether there was a positive association between friend guarding (aggregated) and friend retention.<sup>6</sup> Friend guarding significantly predicted retention when rivals were friends,  $\text{Wald}(1, N = 173) = 4.70, p = .030, \text{Exp}(B) = 1.28, 95\%CI = [1.02, 1.59]$ . Although the trend was in the same direction for romantic partners, this relationship was not significant,  $\text{Wald}(1, N = 194) = 2.05, p = .153, \text{Exp}(B) = 1.18, 95\%CI = [0.94, 1.47]$ . For consistency, we also explored acquaintances. There was not a significant relationship between guarding and retention,  $\text{Wald}(1, N = 162) = 0.94, p = .759, \text{Exp}(B) = 0.95, 95\%CI = [0.67, 1.34]$ .<sup>7</sup> The patterns of data largely hold across participant genders (see Supplementary Materials).

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<sup>6</sup> Correlations among friend guarding tactics are high [all  $r$ s  $< .600$ ], rendering logistic regression models simultaneously including all tactics suboptimal.

<sup>7</sup> We speculate as to why we find this null result here. Friendship jealousy and related friend guarding are quite low when interlopers are acquaintances, consistent with the notion that acquaintances are not typically considered replacement threats. Thus, whereas some acquaintances are not typically considered replacement threats. Thus, whereas some acquaintances might progress to friends and perhaps replacement threats, many might not; many

### Discussion

First, people reported greater friendship jealousy when rivals were same-sex friends than romantic partners (or same-sex acquaintances), replicating findings from Studies 3a, 3b, and 4 (using hypothetical scenarios)—here with recalled real-world events. This suggests that errors in affective forecasting, alone, are unlikely to have caused the results found in previous studies.

Second, people reported greater replacement threat when rivals were same-sex friends versus romantic partners (or acquaintances), and reported greater time threat when rivals were romantic partners than friends (or acquaintances). In combination with analyses showing that replacement threat (but not time threat) mediates the relationship between rival type and recalled friendship jealousy, this provides further evidence that friendship jealousy is more strongly calibrated to replacement than time threats. Moreover, it bolsters confidence in the assumptions that different interlopers are perceived to pose different levels of replacement and time threats. In Study 5b, as predicted, people also reported greater friend-guarding behavior when rivals were friends than romantic partners (or acquaintances). Related mediation analyses suggest that friendship jealousy significantly statically mediated the relationship between rival type and recalled friend-guarding behavior.

To our knowledge, Study 5b also provides some of the first evidence of actual friend retention rates in the face of possible third-party threats, thus speaking to the modern-day efficacy of jealousy-motivated friend guarding. Reports suggest that people retained their best friends ~90% of the time when rivals were acquaintances, but only ~45% of the time when rivals were friends or romantic partners. Note, however, that we asked participants to recall salient acquaintanceships might dissolve or fail to progress. Thus, people might simply not friend guard against their best friends' acquaintances and yet nevertheless achieve high best friend retention.

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friendship-threatening events; these low retention numbers may reflect that people are more likely to recall events that had effects on their friendships (i.e., friendship dissolution).

### **Study 6**

Pre-registered Study 6 builds on Studies 5a and 5b and manipulates on-line friendship jealousy (versus a relatively neutral friend-related control condition) to further explore whether friendship jealousy causes friend-guarding intentions.<sup>8</sup> To do this, Study 6 adapts a paradigm from existing emotions work (e.g., Ashton-James & Tracy, 2012; Ekman et al., 1983; Tracy, personal communication) that evokes emotional experience in the moment. After reading a prompt instructing participants to experience either friendship jealousy at a friend becoming potentially closer with another same-sex person (friendship jealousy) or a typical day spent with their best friend (relatively neutral friend-related control), participants wrote in detail about their current affect, physiology, and musings. Next, participants reported their currently-felt affect (a manipulation check) and the extent to which they would engage in friendship maintenance behavior—both friend guarding (our focal dependent variable) and also everyday friend retention—akin to Study 2.

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<sup>8</sup> To ensure that our manipulations were successful in an online community sample, we ran a pre-registered pilot. Data from the pilot support pre-registered predictions and are further replicated in Study 6. The primary difference between the pilot and the present study is our use of friend-guarding scale items; whereas the pilot assessed only friend guarding-vigilance (as in Study 2b), here, we assess multiple friend-guarding tactics (akin to Study 5b). Data and code from the pilot are on Open Science Framework, and results are reported in detail in the Supplementary Materials.

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We predict that participants in the friendship jealousy condition will (i) experience greater friendship jealousy and (ii) report greater friend-guarding intentions compared to those participants in the relatively neutral friend-related control condition. In the latter condition, we expect participants might feel neutrality (no strong emotionality) and/or happiness. We also explore whether those participants report greater intentions to engage in everyday friend retention than participants in the friendship jealousy condition. Finally, we additionally explore whether currently-felt feelings of friendship jealousy (versus other emotions) might statistically mediate the relationship between condition and reported intentions to engage in friend guarding.

### **Method**

A power analysis indicated that 351 participants would be required for .80 power to detect small- to medium-sized effects ( $f = .15$ ) in friend guarding between the two conditions, thus assessing our focal prediction. We opened a study to 400 US participants on TurkPrime and included bot and attention checks. Of 413 participants who filled out the two critical open-ended items at the start of the survey (same-sex others' names and responses to manipulation), which also served as bot checks, 340 participants (191 female, 1 other/missing;  $M_{age} = 39.96$ ;  $SD_{age} = 13.09$ ) passed both checks, and also correctly answered a late-in-study attention check question (answering a multiple choice question correctly by writing "ethnicity" in the related text box), and were thus included in analyses.

**Procedure and design.** As in previous studies, participants first reported some brief demographic information (sex, age) and were instructed to fill out the names of same-sex others—here, a best friend and an acquaintance. The best friend's name would be piped into the manipulation prompts, whereas the acquaintance name was asked only as part of our bot check, similar to previous studies. Participants then underwent the manipulation, which involved putting

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oneself in a friendship jealousy-evoking scenario or in a typical day spent with the best friend, and then writing a detailed open-ended response about what they are currently experiencing.

What participants wrote here served as the second critical bot check.

We adapted the manipulation from the established Relived Emotion Task (Ekman et al., 1983), here aiming to manipulate participants' on-line affect—friendship jealousy versus a relatively neutral friend-related control condition—by using hypothetical prompts.<sup>9,10</sup> In the *friendship jealousy condition*, participants were instructed: “Imagine that you are feeling very jealous because [name of best friend] has become quite close with another same-sex friend, maybe even closer to that new friend than [name of best friend] is to you. Everyone has, at some time in their lives, felt jealousy when their friends seemed to like another friend better. It's OK to feel this. Give yourself a moment to close your eyes and really experience this jealousy. Describe in as much detail as possible the jealousy that you are feeling. For example, what's going on in your mind, and what are you thinking while you are feeling this jealousy? What's going on in your body—your gut, your arms and legs, your heartbeat—while you are feeling this jealousy?” We included information about friendship jealousy being normative to encourage participants to

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<sup>9</sup> We thank Jessica Tracy for helpful feedback on developing this manipulation.

<sup>10</sup> We asked participants to imagine rather than to *re-live* an emotion because re-living a past, salient friendship jealousy event may have colored participants' responses on the focal measure (intent to friend guard the current best friend). For example, past instances of friendship jealousy may be especially salient because they led to the dissolution of the best friendship; asking about intentions to guard a person who is no longer one's (best) friend could be confusing to participants.

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honestly experience and report their feelings, in line with previous research (Ashton-James & Tracy, 2012; Tracy, Shariff, Zhao, & Henrich, 2011; Zammuner, 1996).

Our *relatively neutral friend-related control condition* was adapted from Ashton-James and Tracy (2012); therein, participants in the neutral condition detailed their activities that day, whereas here participants were instructed: “Imagine that you are spending time with [name of best friend]. There’s no special occasion, rather, it’s just a typical day when you’re spending time together—akin to those you might have had not too long ago. Take some time to really visualize each experience that you are doing on this regular day. Give yourself a moment to close your eyes and really experience each of your activities during this regular, typical day. Describe in as much detail as possible everything that you and [name of best friend] would be doing. For example, what’s going on in your mind and what are you thinking while you are going about your everyday activities? What’s going on in your body—your gut, your arms and legs, your heartbeat—while you are going about your everyday activities with [name of best friend]?”

***Manipulation check.*** Next, participants were asked to report the extent to which they were currently feeling five affective states—friendship jealousy (“jealousy”), neutral (“no strong emotions [neutral]”), “happiness”, “sadness”, and “anger”—on 7-point Likert-type scales (1 = *Not at all*, 7 = *Very much*).

***Friendship maintenance.*** We assessed participants’ behavioral intentions to engage in two types of friendship maintenance behavior: *friend guarding* and *everyday friend retention*. Participants read, “Take a moment to re-experience what you were feeling in your mind and body. Given your feelings *right now*, how likely would you be to...” and responded to 17 items on a 7-point Likert-scale (1 = *Not at all*, 7 = *Very much*).

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We assessed friend guarding via 12 items measuring five tactics that we explored in previous studies: We used two items for Vigilance (e.g., “Check up on [best friend] to see if they're spending time with other people”;  $\alpha = .91$ ); three items for Inducing Jealousy (e.g., “Develop and show off other new friendships you made”;  $\alpha = .82$ ); and five items for Possession Signals (e.g., “Show off how close you and [best friend] are on social media [e.g., posting pictures of you two together]”;  $\alpha = .84$ ). Although people scored highly on the Self/Commitment Enhancement friend-guarding tactic in Study 3a, leading us to use it in Study 5b, some of these items had potential theoretical overlap with everyday friend retention items (e.g., related items assessed being positive in the former and avoiding potentially negative subjects in the latter), so we did not use this tactic. Similarly, although people scored highly on the Separation friend-guarding tactic in Study 3a, leading us to use it in Study 5b, we did not assess Separation because the items required the presence of a likely interloper (e.g., “Try to get your best friend to avoid places where this other person will be”), which would have been confusing and nonsensical for participants in the control condition (where no interlopers were mentioned or expected). Instead, we added Monopolization, the items for which did not require the presence of an interloper (e.g., “Monopolize [best friend]'s time”;  $\alpha = .85$ ). We aggregated scores on these five friend-guarding tactics into one overall measure of friend guarding ( $\alpha = .94$ ).

To assess everyday friend retention, we used five items from Study 2 (e.g. “Be cheerful and positive whenever you're with [best friend]”;  $\alpha = .57$ ).<sup>11</sup> Unlike Study 2, we did not include

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<sup>11</sup> Because of this reliability score, we created a second composite of friend retention that excluded the item “Avoid talking about things that we disagree about.” This second composite had an improved score ( $\alpha = .65$ ). Predicted results do not differ when using either composite (see Supplementary Material).

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the item assessing the social networks tactic (“Rely on other friends to help you through this rough patch”), because it would have been confusing and nonsensical for participants in the control condition (where no rough patch is mentioned or expected).

### Results and Discussion

**Manipulation check.** We ran a 2 (Condition) x 5 [Affective reactions] mixed-factors ANOVA, which yielded main effects of condition,  $F(1, 339) = 57.52, p < .001, \eta_p^2 = .145$ , affective reactions,  $F(4, 1356) = 67.74, p < .001, \eta_p^2 = .167$ , and a significant interaction,  $F(4, 1356) = 92.88, p < .001, \eta_p^2 = .215$ . (These effects, and all those reported below for our focal analyses, hold across participant genders. See Supplementary Material.)

In line with predictions, people reported currently feeling greater friendship jealousy in the friendship jealousy condition ( $M = 4.13, SE = .13$ ) than in the relatively neutral friend-related control condition ( $M = 1.45, SE = .14$ ),  $F(1, 339) = 196.50, p < .001, \eta_p^2 = .367, 95\%CI = [2.30, 3.06]$ . As one might expect, given the links between jealousy and basic affective states of both sadness and anger, people also reported currently feeling more sadness in the friendship jealousy condition ( $M = 3.55, SE = .13$ ) versus the control condition ( $M = 2.05, SE = .14$ ),  $F(1, 339) = 64.87, p < .001, \eta_p^2 = .161, 95\%CI = [1.13, 1.87]$ , and currently feeling more anger in the friendship jealousy condition ( $M = 2.65, SE = .11$ ) versus the control condition ( $M = 1.45, SE = .11$ ),  $F(1, 339) = 60.03, p < .001, \eta_p^2 = .150, 95\%CI = [0.90, 1.51]$ . People in the friendship jealousy condition also reported currently feeling significantly greater friendship jealousy than any other reaction ( $ps < .001$ ).

People reported currently feeling greater neutrality in the control condition ( $M = 4.01, SE = .14$ ) versus the friendship jealousy condition ( $M = 3.19, SE = .13$ ),  $F(1, 339) = 17.21, p < .001, \eta_p^2 = .048, 95\%CI = [0.43, 1.20]$ , and people also reported currently feeling greater happiness in



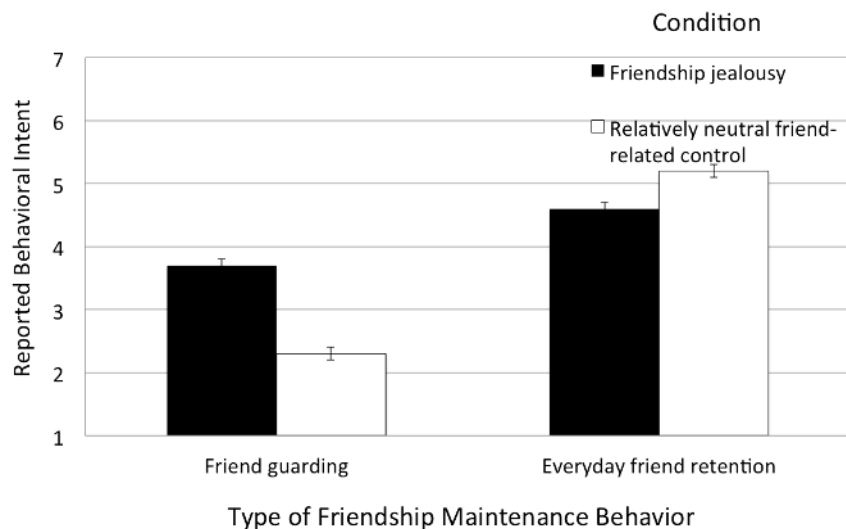
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the control condition ( $M = 4.84$ ,  $SE = .13$ ) versus the friendship jealousy condition ( $M = 3.15$ ,  $SE = .12$ ),  $F(1, 339) = 89.00$ ,  $p < .001$ ,  $\eta_p^2 = .208$ ,  $95\%CI = [1.34, 2.05]$ . People reported currently feeling significantly greater happiness than any other reaction ( $ps < .001$ ) in the relatively neutral friend-related control condition; excepting happiness, people reported currently feeling significantly greater neutrality than any other reaction ( $ps < .001$ ) in the control condition. This seems sensible, given the prompt was to immerse oneself in a typical day with one's best friend.

**Friendship maintenance: Does friendship jealousy cause people to engage in greater friend guarding?** As per the plan, we first conducted a 2 (Condition) x 2 [Friendship maintenance type] mixed-factors ANOVA. (We also report the similar results of a 2 (Condition) x 5 [Tactic] ANOVA in the Supplementary Material.) This yielded main effects of condition,  $F(1, 339) = 29.38$ ,  $p < .001$ ,  $\eta_p^2 = .220$ , type,  $F(1, 339) = 407.98$ ,  $p < .001$ ,  $\eta_p^2 = .546$ , and a significant interaction,  $F(1, 339) = 95.66$ ,  $p < .001$ ,  $\eta_p^2 = .220$ .

Exploring the significant interaction, we find, as predicted, that people in the friendship jealousy condition reported greater behavioral intent to engage in friend guarding ( $M = 3.68$ ,  $SE = .10$ ) than those in the control condition ( $M = 2.30$ ,  $SE = .11$ ),  $F(1, 339) = 84.45$ ,  $p < .001$ ,  $\eta_p^2 = .199$ ,  $95\%CI = [1.08, 1.67]$ . See Figure 8. This suggests that on-line experiences of friendship jealousy cause increased intent to engage in friend guarding.

We also find that people reported greater behavioral intent to engage in everyday friend retention in the relatively neutral friend-related control condition ( $M = 4.85$ ,  $SE = .08$ ) than in the friendship jealousy condition ( $M = 4.57$ ,  $SE = .08$ ),  $F(1, 339) = 6.24$ ,  $p = .012$ ,  $\eta_p^2 = .019$ ,  $95\%CI = [0.06, 0.50]$ , though this effect was comparatively smaller. This echoes similar findings from Study 2. People in both conditions reported greater intent to engage in everyday friend retention than friend guarding ( $ps < .001$ ,  $\eta_p^2_{control} = .554$ ,  $\eta_p^2_{jealousy} = .147$ ).



**Figure 8.** Reported behavioral intent to engage in friend guarding and everyday friend retention as a function of condition. Error bars represent standard errors.

**Focal analysis: Two additional, pre-registered subsamples.** Next, as per the pre-registered plan, we also conducted this same ANOVA on two subsamples of data. Results from both of these subsamples replicate the predicted results reported above. (See Supplementary Materials for more information about these subsamples and detailed results.)

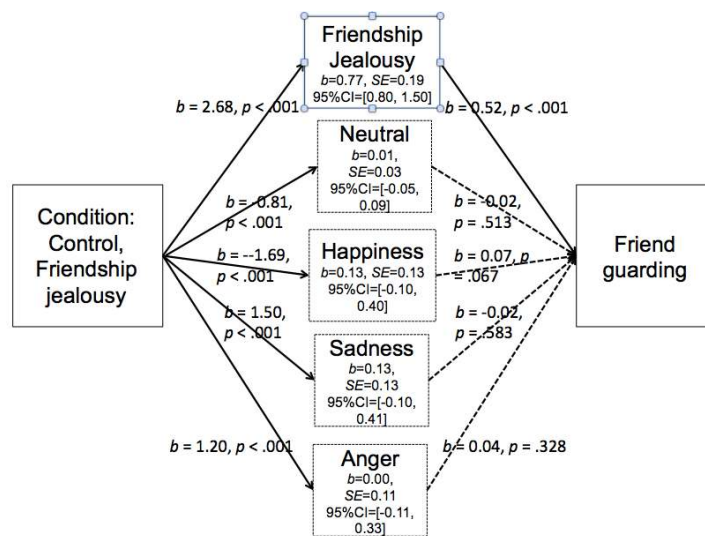
The first subsample included only those participants in the friendship jealousy condition whose manipulation check scores indicated strong levels of self-reported currently-felt friendship jealousy (scores of 4 or higher) in the friendship jealousy condition and only those participants in the control condition whose manipulation check scores indicated low levels of currently-felt negative affect—friendship jealousy, sadness, anger (scores below 4 on those negative emotions)—in the control condition.

The second subsample included only those participants whose written responses to the manipulation—as per the coding of a research assistant blind to hypotheses and

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*manipulations*—indicated strong levels of currently-felt friendship jealousy in the friendship jealousy condition (scores of 4 or higher) and low levels of currently-felt negative affect in the control condition (scores below 4 on those negative emotions).

**Exploratory mediation: Does currently-felt friendship jealousy (or other affective reactions) mediate the relationship between condition and friend guarding?** We explored this using PROCESS Model 4, allowing multiple mediators (friendship jealousy, neutrality, happiness, sadness, anger), using 5,000 bootstrapped samples and 95% bias corrected CIs. As illustrated in Figure 9, and consistent with expectations derived from our model, the indirect effect of condition on friend guarding was significant for friendship jealousy,  $b = 1.39$ ,  $SE = 0.14$ ,  $95\%CI = [1.14, 1.68]$ , and not for any other affective reaction. The direct effect was no longer significant,  $b = 0.07$ ,  $SE = 0.15$ ,  $p = .656$ . This further suggests that on-line experiences of friendship jealousy drive friend guarding.



**Figure 9.** Parallel multiple mediation model depicting the effect of condition on friend guarding, as mediated by self-reported currently-felt affect.

### Study 7

One of the most intriguing findings from several of the preceding studies (3a-5b) is that people reported greater friendship jealousy when friends formed new same-sex friendships (likely posing higher replacement threat, but lesser time threat) than new romantic relationships (likely posing higher time threat, but lesser replacement threat). In combination with mediation analyses from Studies 5a and 5b, those findings support the functional prediction that friendship jealousy is more strongly calibrated to cues of replacement threat, even over other cues that our intuitions might expect—specifically, the amount of time best friends spend with other people. Indeed, we predict that cues with better predictive validity of impending loss (i.e., replacement threat) should receive prioritization in driving levels of friendship jealousy. To further explore this, Study 7 orthogonally manipulates replacement and time threats, manipulating the proposed mediators of friendship jealousy.

Recall that an Alliance Hypothesis perspective on friendship contends that a person's friends are ranked hierarchically in descending order of those one would support in a conflict between those friends (DeScioli & Kurzban, 2009, DeScioli et al., 2011). Relative to lower-ranked friends, higher-ranked friends presumably receive support in conflict and preferential access to other friend-mediated benefits (e.g., resources, information; DeScioli et al., 2011; see also de Waal, 2007). An especially strong illustration of replacement threat might thus be a best friend siding with and/or conferring a contested resource on someone else over oneself.

To vary replacement threat, then, participants imagined that the best friend was attending a desirable social event at which space is limited; the best friend could take only one friend as his/her guest to this event, and both the participant and the new friend voiced desires to attend. In the no-information control condition, the participant is informed only that the best friend can

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take one of them to the event. In the low replacement threat condition, the best friend decides to take the participant (not the new friend). In the high replacement threat condition, the best friend decides to take the new friend (not the participant). To vary time threat, participants were asked to imagine that a best friend has formed a new, close same-sex friendship, and that the best friend is spending either a lot (high time threat) or a little (low time threat) time with this person.

Whereas we expect that friendship jealousy is more strongly calibrated to replacement than time threat, we still expect time threat to affect friendship jealousy in some situations. That is, insofar as the amount of time a best friend spends with a new friend cues the extent to which that new friend might pose a current or eventual replacement threat, we would expect time threat to influence friendship jealousy. Thus, we predict that (i) when there is no information about replacement threat (i.e., in the no-information control condition for replacement threat), time threat will enhance friendship jealousy: The more time that the best friend spends with the new friend, the more friendship jealousy should be evoked. However, (ii) time threat will have less effect on friendship jealousy than will replacement threat: When available, information about replacement threat should largely override the effects of time threat, such that high replacement threat evokes high levels of friendship jealousy, and low replacement threat evokes low levels of friendship jealousy.

### **Method**

**Participants.** A power analysis suggested we would need 432 participants for .80 power to detect small effects ( $f = .15$ ) in reported friendship jealousy given our six-cell between-subjects design. U.S. participants were recruited from MTurk into an approximately 12-minute study in return for small monetary compensation. Given expected attrition, we attempted to recruit 450 participants. Five-hundred and three participants started the survey and reported their

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sex; of these, 428 participants (218 females;  $M_{age} = 38.14$ ;  $SD_{age} = 11.94$ ) filled out focal dependent variables and were included in analyses.

**Procedure.** As in previous studies, participants first answered basic demographic questions about themselves (sex, age) and questions about same-sex friends before imagining and responding to one of six possible scenarios, given the 2 (Time threat: high, low) x 3 (Replacement threat: low, no-information control, high) between-subjects design.

Time threat was operationalized as the amount of time one's best friend was spending with a new same-sex friend. Replacement threat was operationalized via a party scenario. All participants read that their same-sex best friends had been invited to the exclusive birthday party of a same-sex acquaintance they want to know better. Participants are ultimately informed that their best friends can take a guest—but both they (the participants) and their best friends' new friend voiced desires to be that plus one. In the no-information control condition, the scenario stops there. In the low replacement threat condition, participants are informed that their best friends have decided to take them to the event (instead of the new friend); in the high replacement threat condition, participants are informed that their best friends have decided to take the new friend to the event (instead of the participant). See Appendix B for scenarios.

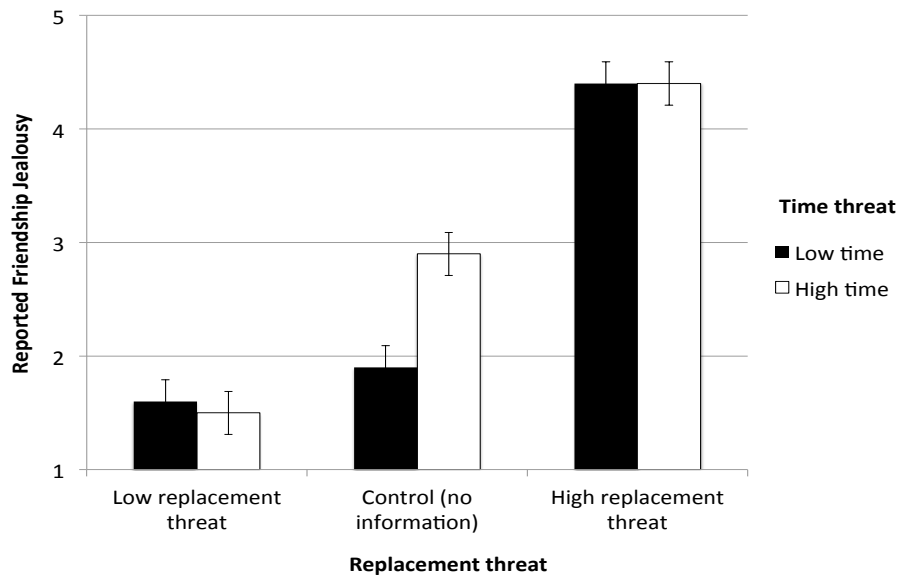
**Reported friendship jealousy.** After reading the scenario, participants reported their reactions, including friendship jealousy, sadness and anger, and distractor reactions (disgust, guilt, pride, happiness, relief, enthusiasm, nothing) on a 7-point Likert-scale (1 = *Not at all*, 7 = *Very much*).

### Results and Discussion

Running the 2 (Time threat) x 3 (Replacement threat) ANOVA yielded a marginally significant main effect of time threat,  $F(1, 422) = 3.29$ ,  $p = .071$ ,  $\eta_p^2 = .008$ , such that scenarios

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presenting high time threat evoked marginally greater reported friendship jealousy ( $M = 2.91$ ,  $SE = .11$ ) than those presenting low time threat ( $M = 2.62$ ,  $SE = .11$ ). We also found a significant main effect of replacement threat,  $F(2, 422) = 112.93$ ,  $p < .001$ ,  $\eta_p^2 = .349$ , such that high replacement threat scenarios evoked significantly greater reported friendship jealousy ( $M = 4.38$ ,  $SE = .14$ ) than control scenarios ( $M = 2.40$ ,  $SE = .14$ ;  $p < .001$ ,  $95\%CI=[1.60, 2.36]$ ,  $\eta_p^2 = .229$ , and control scenarios evoked significantly greater reported friendship jealousy than low replacement threat scenarios ( $M = 1.52$ ,  $SE = .14$ ;  $p < .001$ ,  $95\%CI=[.55, 1.22]$ ,  $\eta_p^2 = .088$ ). See Figure 10. We also found the predicted interaction,  $F(2, 422) = 5.13$ ,  $p = .006$ ,  $\eta_p^2 = .024$ . (Findings did not depend on participant gender; see Supplementary Materials.)



**Figure 10.** Reported levels of friendship jealousy as a function of time threat and replacement threat. Error bars represent standard errors.

In line with predictions, *only* in the no-information control condition for replacement threat did time threat drive results; more time spent with the best friend evoked greater reported

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friendship jealousy ( $M = 2.90$ ,  $SE = .19$ ) than did less time spent with the best friend ( $M = 1.90$ ,  $SE = .20$ ),  $F(1, 422) = 13.38$ ,  $p < .001$ ,  $95\%CI = [.46, 1.54]$ ,  $\eta_p^2 = .031$ .

Time threat did not affect reported friendship jealousy in the low replacement threat condition (when the best friend chose the participant over the new friend), which evoked relatively low levels of friendship jealousy overall ( $M_{high-time} = 1.45$ ,  $SE_{high-time} = .19$ ;  $M_{low-time} = 1.58$ ,  $SE_{low-time} = .20$ ;  $p = .630$ ). Time threat also did not affect reported friendship jealousy in the high replacement threat condition (when the best friend chose the new friend over the participant), which evoked relatively high levels of friendship jealousy overall ( $M_{high-time} = 4.39$ ,  $SE_{high-time} = .20$ ;  $M_{low-time} = 4.38$ ,  $SE_{low-time} = .20$ ;  $p = .984$ ).

At both high and low time threat, high replacement threat evoked greater reported friendship jealousy than did no-information control or low replacement threat ( $ps < .001$ ). At low time threat, friendship jealousy did not differ as a function of low versus control replacement threat ( $p = .248$ ); at high time threat, low replacement threat evoked less friendship jealousy than did control replacement threat ( $p < .001$ ,  $95\%CI = [-1.99, -0.92]$ ,  $\eta_p^2 = .116$ ).

That time threat did not affect reported friendship jealousy when replacement threat information was available suggests that people use time threat as a cue to replacement threat. That is, when more direct information about replacement threat is available, such information more strongly drives friendship jealousy. Thus, the overall pattern of results suggests that friendship jealousy is calibrated more closely to replacement threat than to time threat.

### **Studies 8a & 8b**

Study 8a and pre-registered Study 8b explore the proposed model of friendship jealousy. Specifically, we test the prediction that interlopers posing a presumably higher replacement threat (the best friend becoming close with a new friend versus a new romantic partner; 8a) or



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interlopers specifically described as posing a higher replacement threat (a friend whom your best friend chose over you versus a friend over whom your best friend chose you; 8b) evoke greater friendship jealousy and, in turn, evoke more intense friend-guarding behavior.

To measure friend-guarding behavior, we use a behavioral-choice paradigm from established work on stereotyping and prejudice, wherein chosen seating distance away from a target is an index of antipathy toward that target (e.g., Amodio & Devine, 2006). Here, we task participants with making a similar choice—but for seating their best friends and the interlopers. Seating distance (how many seats apart) is thus an index of the separation that participants create between their best friends and potential interlopers.

### Method

**Participants.** U.S. participants were recruited from TurkPrime into an approximately 8-minute study on social emotions in return for small monetary compensation. For each study, we aimed to attain a sample size of 225. We employed two strong attention/bot checks: assessing whether participants (a) followed critical directions in naming three same-sex friends and (b) correctly responded to an attention-check prompt. Taking a multiverse approach (Steege, Tuerlinckx, Gelman, & Vanpaemel, 2016), we first conducted primary analyses on the data having employed both exclusions; because results do not appreciably differ depending on whether we analyze those passing one or both checks, we present data from those passing only the critical first check because it allows for a larger sample size. (We replicate findings reported below using data from passing both checks in the Supplementary Materials.)

**Study 8a.** Of 270 participants responding to “What is your sex?”, 202 (86 female) passed check 1,  $M_{age} = 36.54$ ;  $SD_{age} = 10.33$ . Sensitivity analysis suggests this yields sufficient (.80) power to detect small- to medium-sized effects ( $f = .20$ ).

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**Study 8b.** Of 243 participants responding to “What is your sex?”, 193 (84 female) passed check 1,  $M_{age} = 36.34$ ;  $SD_{age} = 11.24$ . Sensitivity analysis suggests this yields sufficient (.80) power to detect small- to medium-sized effects ( $f = .20$ ).

**Procedure.** As in previous studies, participants first reported basic demographic information and answered questions about their same-sex friends before reading and responding to one of two possible scenarios.

In Study 8a, participants were randomly assigned to read about a best friend becoming potentially closer with either a same-sex friend or an other-sex romantic partner. In Study 8b, participants were randomly assigned to read about a best friend choosing to take the participant to a desirable event (over the best friend’s new same-sex friend who also wanted to attend) or about that best friend choosing to take the new friend to a desirable event (over the participant who also wanted to attend). For both studies, participants then reported their affective reactions to the scenario and completed the seating distance question and individual difference measures.

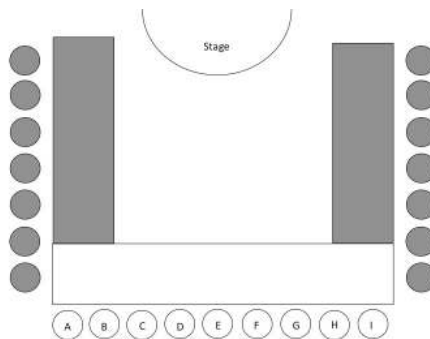
**Reported friendship jealousy.** Following the scenario, participants reported their emotional reactions, including friendship jealousy and distractor emotions (Study 9a: happy, proud, pity; Study 8b: guilt, pity, afraid, comfortable)—on 7-point Likert-scales (1 = *Not at all*, 7 = *Very much*). See Supplementary Materials for all Means [*SEs*] of distractor reactions.

**Chosen seating distance (Friend guarding-separation).** After reporting their reactions, participants read a second prompt: “You're about to take a big trip for work, AND you've been working on helping your group of friends plan a surprise birthday party for one of your mutual friends. Everything is set, but you have one more task to do before you leave for your trip (meaning that, unfortunately, you won't be at the party). You have to make the seating arrangements. Most of it is locked in; that is, there are some people at the side tables that you

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can't move around. But there are other people that you have to assign seats for---including your best friend [name of best friend] and [interloper], who's also coming. You're helping out with the seating at the last minute, so no one will know that you made these seating arrangements.”

Participants viewed a seating arrangement chart (Figure 11) and chose where to seat the best friend and also the interloper (seats A through I). These decisions formed the basis of our second dependent variable, chosen seating distance, which we created by taking the absolute value of the distance between seat choices for the best friend and interloper. Distance scores of 0—meaning best friends and interlopers were sat in the same chair—were not included in analyses.



**Figure 11.** Image viewed by participants in Studies 8a and 8b to examine friend guarding-separation.

## Results and Discussion

### Reported friendship jealousy.

**Study 8a.** We explored reported friendship jealousy caused by interloper types via a one-way ANOVA, finding the predicted effect of interloper type,  $F(1, 197) = 7.50, p = .007, \eta_p^2 = .037, 95\%CI=[0.22, 1.33]$ ; people reported greater friendship jealousy when interlopers were

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friends ( $M = 4.10$ ,  $SE = .20$ ) than romantic partners ( $M = 3.33$ ,  $SE = .20$ ). The patterns of data reported here, and for Study 8b, are largely consistent across participant genders (see Supplementary Materials).

**Study 8b.** We explored reported friendship jealousy caused by interloper types via a one-way ANOVA, finding the predicted effect of replacement threat,  $F(1, 227) = 57.41$ ,  $p < .001$ ,  $\eta_p^2 = .233$ , 95%CI=[1.53, 2.61]; people reported greater friendship jealousy when interlopers posed a higher replacement threat ( $M = 4.76$ ,  $SE = .19$ ) than a lower replacement threat ( $M = 2.69$ ,  $SE = .20$ ). Here, we did find a main effect of participant gender, such that women reported greater friendship jealousy than men.

### **Chosen seating distance (separation).**

**Study 8a.** We conducted a one-way ANOVA, finding that people chose to seat best friends about one seat farther away from friend-interlopers ( $M = 2.79$ ,  $SE = .21$ ) than romantic-interlopers ( $M = 1.69$ ,  $SE = .20$ ),  $F(1, 186) = 14.53$ ,  $p < .001$ , 95%CI=[0.53, 1.68],  $\eta_p^2 = .072$ .

**Study 8b.** We conducted a one-way ANOVA, finding that people chose to seat best friends about one seat farther away from rivals posing high replacement threat ( $M = 3.63$ ,  $SE = .24$ ) than low replacement threat ( $M = 2.49$ ,  $SE = .26$ ),  $F(1, 171) = 10.33$ ,  $p = .002$ , 95%CI=[0.44, 1.83],  $\eta_p^2 = .057$ .

**Does reported friendship jealousy mediate the relationship between interloper type and intensity of friend-guarding behavior?** Yes. To explore the overarching model—that interlopers posing higher replacements threats evoke more friendship jealousy, and, in turn, more intense friend guarding, we used PROCESS Model 4 (Hayes, 2017) for 5,000 bootstrapped samples to compute a bias corrected 95% CI. Whether replacement threat was operationalized

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via interloper type (Study 8a) or explicitly manipulated (Study 8b), greater replacement threat evoked more friendship jealousy and more intense friend-guarding behavior.

**Study 8a.** The analysis indicated a significant indirect effect of replacement threat on friend guarding behavior ( $b = 0.25$ ,  $SE = 0.11$ , 95% CI = [0.07, 0.52]), with the direct effect also significant ( $b = 0.8$ ,  $SE = 0.28$ ,  $p = .003$ , 95% CI = [0.30, 1.41]). When examining mediation among men and women separately, mediation is significant among women but not men.

**Study 8b.** The analysis indicated a significant indirect effect of replacement threat on friend guarding behavior ( $b = 0.74$ ,  $SE = 0.24$ , 95% CI = [0.30, 1.25]), which rendered the direct effect non-significant ( $b = 0.39$ ,  $SE = 0.40$ ,  $p = .331$ , 95% CI = [-0.40, 1.18]). When examining mediation by gender separately, mediation is significant among men but not women.

### General Discussion

We derived predictions about the features that friendship jealousy might possess if it were well-designed to help us solve the likely recurrent challenge of retaining friends in the face of third-party threats. In 11 studies—exploring friendship jealousy via hypothetical scenario, recalled experience, and manipulated on-line experience—we supported predictions regarding the architecture of this emotion: elucidating which inputs do (and do not) evoke friendship jealousy, which cues are prioritized in driving levels of friendship jealousy, and which behavioral outputs friendship jealousy seems to propel (i.e., friend guarding).

First, we predicted and found that friendship jealousy was evoked at the prospective loss of best friends *to third parties* (versus at the prospective loss of friends alone [e.g., as when a friend moves away]). Results are consistent with the expectation that friendship jealousy, unlike often concomitantly-experienced emotions of sadness and/or anger, is uniquely evoked by third-party threats to friendships. Second, friendship jealousy is sensitive to the value of the threatened

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friendship (or friendship closeness), such that the prospective loss of best friends evokes greater friendship jealousy than does the prospective loss of close friends or acquaintances. Third, friendship jealousy is also strongly calibrated to cues that one is about to be replaced. That is, drawing on functional conceptualizations of friendship (e.g., DeScioli & Kurzban, 2009, 2011; DeScioli et al., 2011; Geary, 1998; Silk, 2003; Tooby & Cosmides, 1996; Trivers, 1971), we predicted and found that friendship jealousy is more strongly calibrated to cues that another person is going to usurp one's place in the focal friendship (replacement threat) than it is to best friends simply spending more time with other people (time threat). Fourth, we consistently find that friendship jealousy drives friend guarding, a suite of behavior seemingly well-designed to mitigate third-party threats to friendship.

Across studies, these effects are seemingly specific to friendship jealousy relative to often-concomitant emotions of sadness or anger. It is unlikely that these effects are solely attributable to issues of study design or methodological paradigm (e.g., using within- versus between-subjects design, using hypothetical scenarios). Rather, we support predictions across studies that employ hypothetical scenarios, recalled reactions, and manipulate on-line emotion.

The proposition that friendship jealousy might have arisen to serve some beneficial ends challenges existing concepts of friendship jealousy in scientific research (e.g., Selman, 1980) and also lay intuition (Alford, 2014; Sharp & Welty, 1991), which frame jealousy as maladaptive and/or pathological (for a review, see Buss, 2013). Early accounts of friendship jealousy asserted that such "immature" feelings abate after adolescence in normally-developing individuals. A strong version of this argument might thus expect friendship jealousy would not be present in the majority of adults (Selman, 1980; Selman & Schultz, 1989). However, the present work reveals robust and contextually-dependent levels of friendship jealousy among adults, presumably the

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majority of whom are normally-developing. Rather, findings reported here are in line with a functional view of friendship jealousy.

### **Is Friendship Jealousy Really Adapted?**

We took a functional approach to derive the present predictions, beginning with the premise that jealousy may be a complex reaction tailored by natural selection to coordinate cognition, motivation, physiology, and behavioral outputs in response to recurrent adaptive problems (Nesse, 1990; Sznycer et al., 2016; Tooby & Cosmides, 1990). Yet some of our predictions might be similarly derived from other theoretical approaches or, sometimes, even intuition. How can one make a case that friendship jealousy is an adapted response to an ancestrally-recurrent challenge? After all, unlike bones, cognition does not fossilize.

**Making the case for a recurrent problem linked to fitness.** To make such a case, one might first explore whether sustained friendships likely provided recurrent fitness benefits, and whether third parties posed recurrent threats to the maintenance of those friendships and the receipt of associated benefits. That is, might there be a recurrent problem tributary to reproductive success for friendship jealousy to “solve”?

As noted above, theory and evidence suggest that sustained friendships may have long provided ultimate benefits—both across human cultures and also among non-human primates (Ackerman et al., 2007; Aktipis et al., 2018; Barclay, 2013; Benenson, 2014; Boesch, 2009; Campbell, 2002; David Barrett et al., 2015; De Waal, 2007; DeScioli & Kurzban, 2009, 2011; DeScioli et al., 2011; Dunbar, 2017; Hrdy, 2011; Hruschka, 2010; Lewis et al., 2011; Roberts, 2005; Seyfarth & Cheney, 2012; Schino, 2001, 2006; Shaw et al., 2017; Silk, 2002, 2003; Sugiyama, 2004; Tooby & Cosmides, 1996; Trivers, 1971). Among some non-human primates, for example, the support of merely one ally in some agonistic interactions within small,

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interconnected groups can have huge consequences on whether a disputant leads the group and gleans the related fitness benefits, or suffers potentially lethal expulsion (e.g., Bergman & Sheehan, 2013; de Waal, 2007; Seyfarth & Cheney, 2012). Particularly among female non-human primates, the support of merely one ally can mitigate the negative effects of social stressors—with major impacts on fitness, such as extending one's life or the life of one's offspring (e.g., Palombit et al., 2000; Palombit, Seyfarth, & Cheney, 1997; Silk et al., 2009, 2010; Weingrill, Lycett, & Henzi, 2000). Fitness benefits of sustained friendships have also been demonstrated in other social species, including dogs, horses, cows, and dolphins (e.g., Cameron, Setsaas, & Linklater, 2009; Connor, 2007; Cook, Prichard, Spivak, & Berns, 2018).

There is also theory and evidence to suggest that third parties could have been recurrent threats to friendships. Both modern and ancestral humans—as well as our contemporary non-human primate cousins—interacted in densely interconnected social groups, competed for desirable friends, and invested finite resources in some of those friends over others (DeScioli & Kurzban, 2011; Feld, 1981; Seyfarth & Cheney, 2012). Third-party threats do not require a constant stream of new possible friends in and out of groups; rather, it takes as few as three people for friendships to be threatened: two existing friends and a third party. Thus, even as ancestral humans did not encounter nearly as many new potential friends (e.g., same-sex, similarly aged strangers) as we might today, evidence suggests that they navigated a complex web of social challenges that could be prompted by allies becoming closer with other existing allies and/or newcomers entering one's social group (e.g., Bird et al., 2019). For example, ancestral humans likely migrated into other groups for various reasons, especially after marriage (e.g., Oota, Settheetham-Ishida, Tiwawech, Ishida, & Stoneking, 2001).



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If sustaining friendships in the face of third-party threats could have been a recurrent and fitness-linked challenge, then following Williams (1966; see also Alcock, 1993; Barkow, Cosmides, & Tooby, 1992; Buss, 2013; Lewis et al., 2016; Schmitt & Pilcher, 2004), we can ask whether friendship jealousy shows evidence of ‘special design’ to solve such a challenge. The present work begins to provide some evidence for this, as friendship jealousy appears to be evoked by some threats (but not others), and to spur behavior aimed at mitigating such threats.

**Building a nomological network of evidence that friendship jealousy could have helped meet that recurrent challenge.** An argument for functional significance can also be addressed by a nomological network incorporating diverse forms of evidence (Schmitt & Pilcher, 2004). Such an approach integrates not only (a) theoretical and (b) empirical evidence (e.g., the experimental evidence we present here; see also Burkett, 2009), but also (c) cross-cultural evidence suggesting a psychological phenomenon is reliably developing (i.e., “universal”; Brown, 1991), and (d) phylogenetic evidence of homologous behavior in non-human animals, especially modern primates, suggesting a phenomenon may be highly conserved (e.g., Tinbergen, 1963), among other forms of evidence (e.g., genetic, physiological).

With regard to (c) cross-cultural evidence, accounts of friendship jealousy are found across cultures in the ethnographic record (e.g., Tarascan farmers in Mexico [Friedrich, 1958], Pashtun herders [Lindholm, 1982], Copper Inuit [Condon, 1987], and Guatemalan villagers [Reina, 1959]; see Hruschka, 2010). Although we cannot assess non-human animals’ internal states as we can with humans, (d) there is behavioral evidence consistent with friendship jealousy in non-human animals (e.g., de Waal, 2007; Harcourt, 1992; Schino, 2001; Seyfarth, 1977; Seyfarth & Cheney, 2012). For example, DeScioli and Kurzban (2011) refer to work on chimpanzees “jealously prevent[ing] the formation of rival relationships” (p. 211).

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In line with Schmitt & Pilcher's (2004) suggestions, it could also be interesting to consider other modes of evidence. One could imagine future work exploring physiological responses to distinct friendship threats (e.g., electromyographic activity, skin conductance), testing whether reactivity patterns match those of friendship jealousy reported here (e.g., Pietrzak, Laird, & Stevens, 2002; Takahasi, Matsuura, Yahata, Koeda, Suhara, & Okubo, 2006).

Ultimately, we do not advance the claim that our findings prove friendship jealousy is an adaptation, nor do we suggest that our findings cannot be explained post hoc by alternative frameworks. Rather, we note that our predictions were derived from a functional perspective, that our findings are consistent with the notion of friendship jealousy as a psychological mechanism well-designed to respond to likely recurrent threats of third-party interference, and that no existing framework has generated or tested the predictions we describe here.

### **Potential Limitations and Future Directions**

We argue that friendship jealousy is potentially beneficial insofar as it might spur behavior that helps individuals maintain friendships. However, it is worth asking *whom* friendship jealousy might benefit: actors, friends, and/or third parties? In particular, we speculate that friendship jealousy is beneficial for actors more so than actors' friends or third parties. Indeed, we have not speculated on nor explored the impact of friendship jealousy on focal friends or third parties, as future work should do. Related though, Owens and colleagues (2000) describe harmful possessiveness over friends among teenage girls in Australia. Such possessiveness, which might be a means of friend guarding, is most likely to be harmful to the focal friend and/or the third party, insofar as it prevents the focal friend and third party from enjoying the benefits that might have been associated with the precluded friendship.

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Additionally, although we argue that friendship jealousy can facilitate some positive ends—even as it may be negative to experience—we would not expect that actors feel only aversive reactions when friends form new bonds. Some scenarios might evoke mixed emotions (e.g., both jealousy and pride), for example, as when a best friend forms a romantic relationship. Exploring the full range of these emotions was beyond the scope of the present work.

One might be concerned that, because jealousy is a negative feeling, and/or because friendship jealousy might be considered shameful to experience, there are problems in assessing jealousy via self-report. On this view, one might expect a response bias toward consistently low levels of reported friendship jealousy. However, reported levels of friendship jealousy not only systematically varied in line with nuanced predictions, but they also went above the midpoint of the scale, suggesting that such a response bias is unlikely to be problematic here.

Participants here come from Western, Educated, Industrialized, Rich, and Democratic samples (WEIRD; Henrich, Heine, & Norenzayan, 2010). We would expect friendship jealousy to exist across nations, cultures, subsistence patterns and so on—and evidence suggests that it does (Hruschka, 2010). Future work should include large-scale studies, studies in non-Western samples, and studies in small-scale societies to assess both the possible universality of friendship jealousy as well as possible cultural differences therein (see, e.g., Scelza, 2014; Sznycer et al., 2018a, 2018b). Understanding differing cultural norms about friendship exclusivity, for example, and/or features of different local ecologies (e.g., number of prospective friends we might encounter; Schug, Yuki, Horikawa, Takamura, 2009) could lead to empirically-testable predictions about systematic differences in friendship jealousy (see, e.g., Scelza et al., 2019).

**Friend guarding.** We explored friend guarding to provide support for the notion that friendship jealousy motivates expected behavioral inclinations. There are likely to be multiple

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outputs of friendship jealousy, with friend guarding being just one. Our preliminary investigation suggests further exploration of friend guarding is warranted (see Schützwohl, Joshi, & Abdur-Razak, 2019). Indeed, research on romantic jealousy spurred myriad papers on mate guarding, and we would hope to see future work explore the nuances of friend guarding.

A first question for such future work has to do with a limitation here: at least in Study 3a, self-reported friend-guarding intentions were relatively low. Why? It is possible that our full scale included mating-relevant tactics that people eschew when guarding friends and/or failed to include important tactics unique to friend guarding. Another possibility is that friend guarding is simply not efficacious in modern environments, and thus adults do not engage in it. Because of the observations of friend guarding in non-human animals (e.g., Seyfarth & Cheney, 2012), children and adolescents (e.g., Owens et al., 2000), and in adults across cultures (e.g., Hruschka, 2010), we doubt that this is apt an account. Rather, perhaps adults' friend guarding is quite subtle. After all, people rarely rate 'possessiveness' highly on their list of friendship preferences. Indeed, we would not dispute that some jealousy-evoked reactions could harm friendships, as has been found among children (e.g., Parker et al., 2010); the ultimate benefits that we expect people might glean from friendship jealousy, on average, are not mutually exclusive with some of its more proximate possible disadvantages (e.g., being viewed as a jealous friend). Moreover, perhaps, compared to children, adults are more adept at engaging in tactics of friend guarding that mitigate the undesirable appearance and/or effects of friendship jealousy, while nevertheless acting on that experience in ways that successfully facilitate friendship maintenance.

A second question has to do with the efficacy of friend guarding. Importantly, a functional argument does not depend on modern friend guarding being efficacious. Rather, the approach we take presumes that friendship jealousy arose in response to a recurrent, fitness-

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relevant threat (third parties taking our friends), and that our ancestors who experienced friendship jealousy in germane situations were better able to keep those friends (and enjoy the benefits of doing so). We would not expect, however, that all friend guarding would necessarily be *adaptive* today (though it may still be *adapted*); for example, friend guarding in modern contexts could be *maladaptive* in the clinical sense, such that it can cause some negative outcomes (e.g., among children; Parker et al., 2010). The present work provides initial evidence hinting that friend guarding might be efficacious; participants who recalled having engaged in more friend guarding seemed to have more success in retaining their best friends. However, much more research is needed to explore the costs, benefits, and efficacy of friend guarding (for actors, friends, and third parties).

**Other new avenues for friendship research.** Recently, Kelci Harris and Simine Vazire wrote, “given how important friendships are for health and well-being, it is surprising that friendship has not received more attention from social and personality psychologists” (2016, p. 647). We would similarly sound the call to reinvigorate friendship research, and we believe that the present work serves as one illustration for how researchers might begin to address this issue. That is, even as friendship and other social relationships (e.g., with kin, romantic partners) may each represent distinct social domains, we used the wealth of research on romantic relationships to provide a model for identifying both important challenges (e.g., relationship maintenance) and also possible tools for meeting those challenges (e.g., friendship jealousy) that were understudied in friendships.

In this fashion, we suggest just a few areas of future investigation, beginning with explorations of friend value (in mating: e.g., Buss, 1989; Conroy-Beam & Buss, 2016a, 2016b, 2017; Edlund & Sagarin, 2014; Lewis et al., 2017; Li, Bailey, Kenrick, & Linsenmeier, 2002;

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Schmitt, 2010). For example, people high in friend value are in greater demand on the friend market (Krems & Conroy-Beam, 2020); they might thus be the targets of more friendship poaching attempts and perhaps also be more jealously guarded by their existing friends. Similarly, just as some romantic interlopers are considered more threatening than others (e.g., especially attractive women), so too might certain friend interlopers be considered especially threatening and thus likely to evoke high levels of friendship jealousy.

Related, Pat Barclay (2013) actually suggests a polygyny threshold, “whereby individuals must choose between befriending high-value partners who offer less time to each of many friends versus befriending low-value partners who offer much more devotion to fewer friends” (p. 170). This raises the question of whether people might employ differing friendship strategies—akin to mating strategies (e.g., Buss & Schmitt, 1993; Simpson & Gangestad, 1992)—whereby some invest less in any one friend, and others invest heavily in one friend at a time. If so, who pursues these different strategies, and what are their consequences for strategists’ health and well-being?

Slightly further afield, one might also use existing work on romantic relationships as a playbook to explore understudied features such as friendship (dis)satisfaction, sustainment, and/or dissolution—and the features that predict them (in mating: e.g., Amato, 2000; Meltzer & McNulty, 2010; Meltzer, McNulty, Jackson, & Karney, 2013; White, 1990). For example, Conroy-Beam, Goetz, and Buss (2016) found that the interplay between the mate values of an actor, their romantic partner, and the actor’s possible alternative mates better predicted actor relationship satisfaction than did having a romantic partner who fulfilled all the actor’s mating preferences. No similar work explores this in friendships. Indeed, with increasing attention being paid to loneliness—which affects roughly a third of people in industrialized countries—and its

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negative consequences (e.g., increased mortality risk) as a public health problem (Cacciopo & Cacciopo, 2018; Murthy, 2017), unlocking the secrets to successfully sustaining friendships would seem to be a pressing problem with important practical implications.

### **Conclusion**

Friendship jealousy possesses features one would expect of an apt tool for friend retention—specifically, a tool that is well design to help prevent the loss of valued friends to other people. Friendship jealousy seems uniquely evoked by threats that others might pose to our friendships, is calibrated to how much we value our friends and to how likely it is we might lose those friends (and thus any friendship-derived benefits), and friendship jealousy also seems to motivate us to engage in behavior aimed at preventing such loss. In sum, friendship jealousy might be unpleasant to experience, but it may nevertheless help us maintain our friendships, making it one important but previously overlooked tool of friendship maintenance.

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Appendix A

Friend guarding measures employed (data shown for best friend + new same-sex friend) in Study 3a (overall  $\alpha = .97$ )

<i>Vigilance</i>	$\alpha = 0.77$
Check up on your best friend, to see if they're with this person or not	
Snoop through your best friend's social media to see if they're hanging out with this person	
<i>Separation</i>	$\alpha = 0.86$
Stay close to your best friend when you're at parties or in places with this other person	
Try to get your best friend to avoid places where this other person will be	
Try to keep your best friend from chatting with this other person	
Try not to let your best friend hang out with this person when you're not there	
<i>Monopolization</i>	$\alpha = 0.85$
Spend all your free time with your best friend so they can't become closer with this other person	
Monopolize your best friend's time	
<i>Induce Jealousy</i>	$\alpha = 0.87$
Develop and show off other new friendships you made	
Show interest in becoming best friends with other people to make your best friend jealous	
Try to make your best friend jealous of your friendships with other people	
<i>Punish/Threaten Friend</i>	$\alpha = 0.81$
Become angry when your best friend hangs out too much with this other person	
Threaten to end your best friendship	
Yell at your best friend for becoming close with this other person	
Act overtly jealous when your best friend hangs out with this person	
<i>Emotional Manipulation</i>	$\alpha = 0.75$
Tell your best friend how dependent you are on them	
Make your best friend feel guilty for becoming close with this person	
Threaten to harm yourself	
Act sad when your best friend talks too much about or hangs out too much with this other person	
<i>Derogate Rival</i>	$\alpha = 0.91$
Say negative things about this other person's appearance to your best friend	
Start or repeat negative gossip about this other person to your best friend	
Point out this other person's flaws to your best friend	
Talk about this other person's promiscuousness to your best friend	
Talk to your best friend about how manipulative and untrustworthy this other person is	



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Talk to your best friend about a time when this other person was mean to you or to a mutual friend	
<i>Self/Commitment Enhancement</i>	$\alpha = 0.83$
Show your best friend how committed you are to them	
Enhance your own physical appearance	
Go out of your way to be nice to your best friend	
Emphasize your love and caring toward your best friend	
Give in to your best friend's every whim	
<i>Possession Signals</i>	$\alpha = 0.93$
Introduce your best friend as "your best friend" to other people	
Tell everyone how close you and your best friend are	
Mention to this other person how close you and your best friend are	
Show off how close you are with your best friend when other people are around (e.g., by making inside jokes)	
Show off your commitment to your best friend (e.g., getting best friend jewelry, matching tattoos, matching jerseys)	
Show off how close you and your best friend are on social media (e.g., posting pictures of you two together)	
<i>Derogation of Best Friend</i>	
Tell this other person negative things about your best friend so that they don't pursue a friendship with them	
<i>Indirect Aggression toward Rival</i>	$\alpha = 0.84$
Stare coldly at this other person	
Exclude this other person from social gatherings	
Get your other friends to be mean to this other person	
<i>Direct Aggression toward Rival</i>	$\alpha = 0.77$
Be mean to this other person	
Confront this other person for trying to steal your best friend	
Hit this other person	
Vandalize the property of this other person	

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### Appendix B: Scenarios from Study 7

Imagine that [name of best friend] and another man (woman), [name of best friend]'s new close friend, have started to really enjoy one another's company. You didn't know this new man very well before he (she) became friends with [name of best friend] just recently, but now [name of best friend] and he (she) have clearly become close. [Name of best friend] has introduced this new person into your friend group, as well.

Low time threat: You notice that [name of best friend] and this new man (woman) don't hang out together a lot; they aren't spending lots of time together—they don't have lunch together or hang out together much at all.

High time threat: You notice that [name of best friend] and this new man (woman) are hanging out together a lot; they are really spending lots of time together—having lunch together and hanging out together a lot.

Low replacement threat: A few days ago, you found out that your best friend has received a much-wanted invitation to an upcoming birthday party--it's a party for another guy (girl) you really like, but haven't had time to get to know very well. This party is going to be a swanky, exclusive dinner party. Although you're not that close with the person having the party, your best friend is. And a few of your other, mutual friends have also been invited.

It's a dinner party at a small new restaurant, so space is limited. But your best friend is allowed to take one friend to the party with him (her). You really want to go! You also know that [name of best friend] 's new friend already asked [name of best friend] if he (she) would take him (her).

Both you and [name of best friend] 's new close friend really want to go, so your best friend is going to have to choose which one of you to take to the party.

Today, [name of best friend] tells you that he has decided to take you to the party instead of his (her) new friend.

High replacement threat: A few days ago, you found out that your best friend has received a much-wanted invitation to an upcoming birthday party--it's a party for another guy (girl) you really like, but haven't had time to get to know very well. This party is going to be a swanky, exclusive dinner party. Although you're not that close with the person having the party, your best friend is. And a few of your other, mutual friends have also been invited.

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It's a dinner party at a small new restaurant, so space is limited. But your best friend is allowed to take one friend to the party with him (her). You really want to go! You also know that [name of best friend] 's new friend already asked [name of best friend] if he (she) would take him (her).

Both you and [name of best friend] 's new close friend really want to go, so your best friend is going to have to choose which one of you to take to the party.

Today, [name of best friend] tells you that he has decided to take his (her) new friend to the party instead of you.