



タイトル Title	Commitment signals in friendship and romantic relationships
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掲載誌・巻号・ページ Citation	Evolution and Human Behavior,36(6):467-474
刊行日 Issue date	2015-11
資源タイプ Resource Type	Journal Article / 学術雑誌論文
版区分 Resource Version	author
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DOI	10.1016/j.evolhumbehav.2015.05.002
JaLDOI	
URL	<a href="http://www.lib.kobe-u.ac.jp/handle_kernel/90003509">http://www.lib.kobe-u.ac.jp/handle_kernel/90003509</a>

**Commitment Signals in Friendship and Romantic Relationships**

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***Accepted for Publication in Evolution and Human Behavior***

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### **Abstract**

Due to the ever-present allure of potentially more appealing or attractive partners, people in mutually committed relationships face a commitment problem (i.e., uncertainty about partner fidelity). This problem exists for both friendship and romantic relationships. In an exploratory pilot study, participants described real-life commitment-confirming incidents in either friendship or romantic relationships. The results revealed that the same types of pro-relationship acts (e.g., throwing a surprise party) were used to communicate commitment to one's partner in both types of relationship. Using signaling theory, we predicted that costly commitment signals would be more effective than non-costly commitment signals (Hypothesis 1). Also, we predicted that failure to engage in such behaviors would communicate non-commitment, and that such failures would have a more detrimental effect on romantic relationships than friendship (Hypothesis 2). Two scenario experiments (Study 1 in Japan and Study 2 in the U.S.) were conducted to test these hypotheses. The results showed that costly commitment signals were more effective than non-costly commitment signals in both Japan and the U.S. In addition, the absence of situationally appropriate commitment signals (e.g., forgetting a special occasion) was substantially more damaging to romantic relationships than to friendship.

*Keywords:* romantic relationships, friendship, commitment signals, commitment problem

## 20 1. Introduction

21 Friendship and romantic relationships (i.e., two types of close non-kin relationships) are  
22 associated with a catalog of benefits ranging from increases in self-reported well-being and  
23 happiness to improvements in the immune system functioning, lower rates of cardiovascular  
24 disease, and reduced mortality (Argyle, 1987; Cacioppo & Patrick, 2008; Holt-Lunstad, Smith,  
25 & Layton, 2010; Jaremka, Derry, & Kiecolt-Glaser, 2014; House, Landis, & Umberson, 1988;  
26 Myers & Diener, 1995). Despite these beneficial effects, the effective maintenance of friendship  
27 and romantic relationships poses a difficult adaptive problem, the so-called *commitment problem*  
28 (Schelling, 1960; Frank, 1988; Nesse, 2001). Suppose that Jessie and Jordan are in a close  
29 relationship (gender neutral names are used to emphasize similarities between friendships and  
30 romantic relationships). When Jessie encounters a more appealing or attractive relationship  
31 partner, Jessie might desert Jordan. The same holds Jordan. Problematically, the presence of this  
32 doubt may deter Jessie and Jordan from deepening their existing relationship. Therefore, in order  
33 to maintain a close relationship and to reap benefits from it, both parties must be able to (1)  
34 effectively commit themselves to their current partner and (2) credibly communicate this  
35 commitment.

36 Frank (1988) pointed out that certain emotions can help solve the first half of the  
37 commitment problem (i.e., the problem of steadfastly committing to one's partner). Love, for  
38 example, functions as a commitment device that promotes long-term commitment and, at times,  
39 what appears to be irrational devotion (Campbell & Ellis, 2005). Those who are in love tend to  
40 devalue attractive potential partners by, for example, paying less attention to them and/or  
41 perceiving them as less attractive than they actually are (Gonzaga, Haselton, Smurda, Davies, &  
42 Poore, 2008; Johnson & Rusbult, 1989; Lydon, Meana, Sepinwall, Richards, & Mayman, 1999;  
43 Maner, Gailliot, & Miller, 2009; Miller, 1997; Simpson, Gangestad, & Lerma, 1990). Other

44 emotions, such as gratitude and guilt, may also serve as a commitment device (Frank, 1988;  
45 Trivers, 1971).

46 Solving the second half of the commitment problem (i.e., genuinely communicating one's  
47 commitment) is more difficult than it might first appear. This is because talk is cheap (Farrell,  
48 1987): Jessie's swearing "best friends forever" or "till death do us part" does not warrant that  
49 Jessie will stay in the relationship with Jordan when another more appealing person becomes  
50 interested in Jessie. Frank (1988) maintained that the key to solve this second problem lays in  
51 emotional expressions that are "hard-to-fake." Romantic love, for example, is associated with an  
52 array of hard-to-fake expressions, such as the Duchenne smile and unconscious gesticulation  
53 (Gonzaga, Keltner, Londahl, & Smith, 2001; Gonzaga, Turner, Keltner, Campos, & Altemus,  
54 2006). Nevertheless, other types of commitment signals have not been well studied. To  
55 counteract this imbalance, the present study investigates how commitment to one's friend or  
56 romantic partner can be credibly communicated via pro-relationship commitment signaling  
57 behaviors.

### 58 *1.1. Costly commitment signals*

59 Emotional expressions may not be the only way to communicate commitment. According  
60 to the Costly Signaling Theory (CST; Grafen, 1990; Zahavi & Zahavi, 1997), the costliness of  
61 producing a signal reveals information about the honesty of the signal. Recently, CST has been  
62 successfully applied to interpersonal processes, such as trust recovery and reconciliation  
63 (Ohtsubo & Watanabe, 2009; Ohtsubo & Yagi, 2015). The logic of CST in the context of  
64 commitment is as follows: When Jordan uses his/her resource (e.g., money, time) to maintain a  
65 relationship with Jessie (e.g., purchasing a birthday present for Jessie), Jordan has to relinquish  
66 other activities/opportunities that the same resource would afford (e.g., purchasing a gift for

67 someone else). The greater the cost that Jordan incurs, the more activities/opportunities Jordan  
68 has to give up. Therefore, costly pro-relationship behaviors honestly signal how strongly Jordan  
69 commits to the relationship with Jessie. Previous research suggests that the following three types  
70 of commitment related behavior may be classified as costly signals.<sup>1</sup>

### 71 *1.1.1. Gift giving*

72 Game theoretic analyses have shown that a particular kind of gift may serve as an  
73 effective commitment signal (Bolle, 2001; Camerer, 1988; Sozou & Seymour, 2005). The gift  
74 must not be too valuable to the recipient, lest the gift-giver become vulnerable to exploitation  
75 (e.g., by “gold diggers”). Yet the gift must be costly to the gift-giver, lest it cease to function as a  
76 signal. Thus, the best kind of gift for signaling commitment is one that is extravagant yet  
77 intrinsically worthless (e.g., a dozen long stem red roses). In support of this main prediction, a  
78 scenario experiment by Robben and Verhallen (1994) revealed that recipients find the same gift  
79 more preferable when a gift-giver incurs time and physical/psychological costs in obtaining it  
80 (see also Algoe, Haidt, & Gable, 2008, for the relationship-promoting effect of personalized, as  
81 opposed to impersonal, gifts in sororities).

### 82 *1.1.2. Self-sacrifice*

83 Forgoing one’s “immediate self-interest to promote the well-being of a partner or  
84 relationship” (Van Lange et al., 1997, p. 1374) may also qualify as an effective commitment

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<sup>1</sup> It is important to note that these behaviors may also be classified as indices, as opposed to signals, insofar as their signaling function may be a byproduct of another (non-signal related) evolved function (Maynard Smith & Harper, 2003). Nevertheless, because we are interested in how these behaviors may function as signals of commitment, we have chosen to approach them as signals.

85 signal. Defined as such (i.e., including the promotion of the partner's well-being), however, self-  
86 sacrifice may be thought of as conceptually equivalent to giving an intrinsically valuable gift.  
87 Accordingly, self-sacrifice may appear to be an insufficient communicative medium because  
88 signalers (i.e., those who are prone to make great sacrifices for their relationship partner) are  
89 vulnerable to freeloaders who could unilaterally benefit from their committed partners' sacrifices  
90 without returning any favors (Sozou & Seymour, 2005). Nonetheless, several lines of evidence  
91 support the idea that self-sacrifice serves as a valid commitment signal: Those who are  
92 committed to their romantic partners are more willing to undergo sacrifices, such as donating a  
93 kidney for their partner (Powell & Van Vugt, 2003); recipients of sacrifices perceive their  
94 partners to be more committed (Ohtsubo & Murakami, unpublished data); and the amount of  
95 sacrifices within a romantic relationship predicts long-term relationship functioning (Stanley,  
96 Whitton, Sadberry, Clements, & Markman, 2006; Van Lange et al., 1997).

### 97 *1.1.3. Stress tolerance*

98 Commitment may also be communicated by tolerating a stress imposed by one's partner  
99 (Kelley, 1983; Zahavi, 1977). Zahavi argued that the strength of a bond can be tested by  
100 inflicting some stress on one's partner: If the partner is truly interested in the relationship, the  
101 partner should sustain the stress. In this way, the tested individuals are forced to reveal their  
102 commitment to the relationship. Although this idea has not yet been directly examined among  
103 humans (see Maestripieri, 2012; Perry, 2011, for evidence in non-human primates), there is some  
104 supportive evidence. For example, people are more forgiving of transgressions inflicted by their  
105 close partners than distant others (Finkel, Rusbult, Kumashiro, & Hannon, 2002; Karremans et  
106 al., 2011).

107           The notion of stress tolerance differs from the commitment signals via gifts/self-  
108 sacrifices in terms of who moves first. For commitment signals, the signaler moves first, while  
109 for stress tolerance, the signal recipient moves first by inflicting some stress on the potential  
110 signaler. Despite this difference, these two cases are game-theoretically equivalent, as both can  
111 be subsumed under the rubric of signaling game (Rasmusen, 2007). In addition, in real life  
112 contexts, it may be nebulous whether the partner voluntarily acted in a pro-relationship manner  
113 or the recipient implicitly required the partner to do so. Therefore, in the present research, we do  
114 not make distinction between spontaneous vs. solicited behaviors that signal commitment.

### 115 *1.2. The effectiveness of non-costly commitment signals*

116           The above arguments have emphasized the role of cost, either financial or physical, when  
117 communicating commitment to one's partner. However, every commitment signal does not  
118 necessarily involve financial or physical cost. Considerate statements based on consistent social  
119 attention, for example, might credibly communicate commitment (Dunbar & Shultz, 2010;  
120 Ohtsubo et al., 2014). Imagine a scenario where Jordan has been exhibiting some signs of  
121 depression. If Jessie has been paying attention to Jordan, Jessie is able to note Jordan's problem  
122 and respond in a considerate manner by making statements such as, "I noticed you've been  
123 feeling down lately." It is noteworthy that Jessie must allocate a certain amount of attention, a  
124 cognitive resource, to Jordan in order to make contextually appropriate remarks (see Sutcliffe,  
125 Dunbar, Binder, & Arrow, 2012, for a similar argument in the context of time allocation in social  
126 networks). Because the capacity for attention is limited, paying attention to Jordan entails some  
127 opportunity cost, such as being less able to pay attention to other potential partners. Therefore,  
128 pro-relationship behaviors that entail little production cost (e.g., verbal assurances) may still  
129 serve as commitment signals. Nonetheless, it is still expected that financially or physically costly

130 forms of pro-relationship behaviors will, on average, have a stronger commitment confirming  
131 effect than (relatively) non-costly ones.

132 Hypothesis 1: *Costly commitment signals are more effective to communicate one's*  
133 *commitment to the relationship than non-costly commitment signals.*

### 134 1.3. *Symmetry and asymmetry of friendship and romantic relationships*

135 It is important to note that as the commitment problem pertains to any type of intimate  
136 relationship, all of the above arguments readily apply to both friendship and romantic  
137 relationships. Therefore, a corollary from the above arguments is as follows: Similar pro-  
138 relationship behaviors should serve to confirm the presence or absence of commitment in both  
139 friendship and romantic relationships. If we ask people to describe events that have confirmed  
140 the presence of commitment in their friends or romantic partners, they ought to report similar  
141 events.

142 Corollary: *Commitment confirming narratives in friendship and romantic relationships*  
143 *include similar pro-relationship behaviors.*

144 Despite this similarity, strong commitment might be more important in romantic  
145 relationships than in friendship. First, while people usually maintain simultaneous friendships  
146 with multiple allies, the simultaneous maintenance of multiple romantic relationships, especially  
147 in the context of long-term mating, is rare (a possible exception is high-ranking individuals in  
148 polygynous societies). Second, there is some evidence that romantic relationships are given  
149 priority over friendship. For example, developing a romantic relationship is one of the major  
150 causes of friendship dissolution (Rose, 1984). People in later stages of romantic relationships  
151 (e.g., engaged couples) tend to interact with fewer friends than those in earlier stages (Milardo,  
152 Johnson, & Huston, 1983).

153           If the commitment problem is indeed more important in romantic relationships than in  
154 friendship<sup>2</sup>, this yields a testable hypothesis. To the degree that a person is concerned about their  
155 partner's commitment, the partner's failure to produce a signal of commitment might be  
156 perceived as a serious threat to the relationship. Therefore, we predicted that the partner's failure  
157 to produce a relevant commitment signal would have differential impact on the two types of  
158 relationship based on their asymmetrical importance.

159           Hypothesis 2: *A partner's failure to produce a situationally appropriate commitment*  
160 *signal has a more detrimental effect on romantic relationships than friendship.*

161           The present research consisted of three separate studies. A pilot study sampled  
162 participants' direct or observed experiences of relationship-confirming incidents. Based on the  
163 results of the pilot study, we wrote scenarios used in the subsequent studies. In addition, the pilot  
164 study data were used to test the corollary. Two scenario experiments, each conducted in Japan  
165 (Study 1) and the United States (Study 2), consisted of two parts. In Part A, we tested whether  
166 costly commitment signals were more effective than non-costly commitment signals. In Part B,  
167 we tested whether failures to produce situationally appropriate commitment signals would have  
168 more detrimental effect on romantic relationships than friendship.

## 169 **2. Pilot Study**

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<sup>2</sup> It is possible that this asymmetry is a characteristic of modern societies where the role of committed friendship (i.e., mutual aid) has been largely replaced by modern technologies and institutions, such as medicine and law enforcement (Buss, 2000). In fact, cross-cultural comparisons suggest that loyalty to one's friend decreases as a function of increases in economic/political stability (Hruschka, 2010).

170           The purpose of the pilot study was to identify common pro-relationship behaviors that  
171 effectively communicate commitment to a relationship.

### 172 *2.1. Method*

173           Participants were 164 Japanese undergraduates (81 females, 83 males;  $M_{AGE} \pm SD =$   
174  $19.24 \pm 0.97$  years) at a large university in Japan. Using a free response format, participants  
175 described real-life episodes whereby commitment in either romantic relationships or friendship  
176 was confirmed. Relationship type (friendship vs. romantic relationships) was a between-  
177 participants factor. We then compared the major themes of these episodes between the two types  
178 of relationship.

### 179 *2.2. Results and discussion*

180           The first author read through all episodes and identified 11 frequently described themes:  
181 (1) providing social support, (2) listening to a partner's personal problems, (3) providing  
182 approval/defense as an ally against a third person, (4) engaging in a costly pro-relationship  
183 behavior on a special occasion (e.g., planning and having a surprise party, giving a birthday  
184 present), (5) engaging in a non-costly pro-relationship behavior on a special occasion (e.g.,  
185 giving a birthday wish), (6) visiting or having a contact with a partner, (7) showing tolerance to a  
186 partner's misdeed, (8) engaging in activities with a partner, (9) the mere fact of knowing each  
187 other for a long period of time, (10) visiting a sick/injured partner, and (11) keeping a partner's  
188 secret. Some of the 11 themes were not mutually exclusive. For example, the second and the  
189 third themes were considered as subcomponents of the first theme (i.e., social support).  
190 Nonetheless, we decided to code these themes separately because these specific episodes  
191 repeatedly appeared in many participants' reports. The reliability of the first author's coding was

192 confirmed by comparing her scores with the scores of independent coders (see Supplementary  
193 Materials for details on our coding procedure).

194 Table 1 shows the frequency (relative frequency) of each theme as a function of  
195 relationship type. All themes appeared in both conditions except that the eleventh theme (i.e.,  
196 keeping a partner's secret) was reported only in the friendship condition. Table 1 illuminates  
197 marked similarity in the reported commitment-confirming episodes in the friendship and  
198 romantic relationships conditions. The 11 themes' reported frequencies in the two relationship-  
199 type conditions were highly correlated: Pearson product-moment  $r_9 = .74, p = .009$  (the  
200 comparable correlation based on the rank data failed to reach the statistically significant level  
201 due to the small degrees of freedom: Spearman's  $\rho = .47, p = .14$ ). Therefore, it can be said that  
202 similar pro-relationship behaviors serve as commitment signals in both friendship and romantic  
203 relationships (Corollary was confirmed).

204 In both the friendship and romantic relationships conditions, participants reported non-  
205 costly as well as costly pro-relationship behaviors (see Supplementary Materials for details of the  
206 cost coding procedure). Interestingly, costly pro-relationship behaviors were more prevalent in  
207 the romantic relationships condition ( $.49 = 47/96$ ) than in the friendship condition ( $.27 = 28/103$ ),  
208  $p = .002$  by Fisher's exact test. This result is consistent with the assumption underlying  
209 Hypothesis 2: Assessing the partner's commitment is more important in romantic relationships  
210 than friendship.

211 In the pilot study, we collected episodes that university students frequently experienced  
212 in their relationships. These episodes included both costly and non-costly pro-relationship  
213 behaviors that serve to signal commitment. These data allowed us to write the two types of  
214 scenarios, costly and non-costly pro-relationship behavior scenarios, used in Studies 1 and 2.

### 215 3. Study 1

216 The purpose of Study 1 was twofold (i.e., testing Hypotheses 1 and 2). First, we tested  
217 how costly versus non-costly pro-relationship behaviors affected participants' perceptions of  
218 partner-commitment in friendship and romantic relationships (Part A). Second, we tested  
219 whether the partner's failure to perform situationally relevant pro-relationship behaviors is more  
220 damaging in romantic relationships than friendship (Part B).

#### 221 3.1. Method

##### 222 3.1.1. Participants

223 Participants were 156 Japanese undergraduates at a private university in Japan (98  
224 females, 58 males;  $M_{AGE} \pm SD = 18.64 \pm 0.95$  years) after one participant was excluded from  
225 analyses for failing to complete the questionnaire. Of the 156 participants, 61 (39%) reported that  
226 they had never been involved in a romantic relationship. However, excluding these participants  
227 did not change the reported results.

##### 228 3.1.2. Materials and design

229 Study 1 consisted of two parts. To test Hypothesis 1, Part A of Study 1 employed a 2  
230 (relationship type: friendship vs. romantic relationships)  $\times$  2 (cost: costly vs. non-costly)  $\times$  3  
231 (scenario type: instrumental support vs. emotional support vs. special occasion) factorial design.  
232 Relationship type condition was a between-participants factor, while cost condition and scenario  
233 type condition were within-participant factors.

234 Providing social support (themes 1, 2, and 3) and engaging in costly/non-costly pro-  
235 relationship behaviors on a special occasion (themes 4 and 5) were two pervasive meta-themes in  
236 Study 1 (see Table 1). As the social support literature often makes distinction between  
237 instrumental support and emotional support (e.g., Brown, Brown, House, & Smith, 2008; House,

238 Kahn, McLeod, & Williams, 1985), we created instrumental support and emotional support  
239 scenarios, separately. Consequently, there were three sets of scenarios for Part A: “Instrumental  
240 support,” “emotional support,” and “special occasion.” For each of these scenarios, we created  
241 costly and non-costly versions, for a total of six scenarios (see Table A1 in Appendix for the  
242 scenarios). For example, the non-costly version of the emotional support scenario described a  
243 situation where the participant’s friend/partner cheered up the participant after he/she did quite  
244 poorly on an important class presentation, while in costly version described a situation where the  
245 participant’s friend/partner skipped one of his/her required courses to comfort the participant.  
246 The participants read six (three scenarios × two cost versions) scenarios in either the friendship  
247 or romantic relationships condition. For each of the six scenarios, the participants indicated  
248 agreement with the following statements: *This improves my bond with my friend/romantic*  
249 *partner* and *This improves my trust in my friend/romantic partner*. These two items, embedded in  
250 filler items, were accompanied by a 4-point scale (0: *not at all* to 3: *very much*).

251 To test Hypothesis 2, Part B of this study included 11 scenarios that described a situation  
252 in which the partner failed to engage in a situationally appropriate pro-relationship behavior (see  
253 Table A2 in Appendix for the scenarios). These 11 scenarios covered the 11 themes in Study 1  
254 with two exceptions. First, it was impossible to write a failure scenario based on the mere fact of  
255 knowing each other for a long period of time (theme 9). Second, failing to produce a costly  
256 commitment signal on a special occasion (theme 4) could be construed as either “doing nothing  
257 on a special occasion” or “engaging in a non-costly pro-relationship behavior on a special  
258 occasion.” The former was equivalent to the failure to give a wish for a special occasion (theme  
259 5), while the latter could be considered as an instance of giving a wish. Therefore, for these two  
260 themes, failure scenarios were not written. Instead, we wrote two additional scenarios about

261 sharing a positive personal event and sharing a negative personal event because it has been  
262 shown that relationships can be enhanced by sharing positive and negative personal events (e.g.,  
263 Argyle & Henderson, 1984; Derlega, Metts, Petronio, & Margulis, 1993; Reis et al., 2010).  
264 Again, relationship type was a between-participants factor, and each participant read the 11  
265 scenarios. The anticipated damage to the relationship was measured by a single item: *This*  
266 *worsens our relationship*. The magnitude of damage for their relationships was rated on a 4-point  
267 scale.

268 In both Parts A and B, participants responded to each scenario using all three previously  
269 mentioned items (i.e., improvement in bond, improvement in trust, and worsening of the  
270 relationship). Items for Part A served as filler items for Part B and vice versa. In addition, we  
271 included another filler item irrelevant for the present purpose.

### 272 3.2. Results and discussion

#### 273 3.2.1. Part A

274 The effect of sex was not significant in all analyses, and for brevity, we did not include  
275 sex in the reported analyses. The six responses to the pro-relationship behavior scenarios (i.e.,  
276 three scenarios  $\times$  two items) were internally consistent in both costly and non-costly conditions  
277 (Cronbach's  $\alpha$  was .79 and .82 in the costly and non-costly conditions, respectively). Therefore,  
278 the six scores were aggregated within each condition. A 2 (relationship type: friendship vs.  
279 romantic relationships)  $\times$  2 (cost: costly vs. non-costly) mixed-design ANOVA, with repeated  
280 measures of the latter factor, revealed a significant main effect of cost,  $F_{1, 154} = 94.26, p < .001$ ,  
281 95% confidence interval of effect size (95% CI<sub>effect size</sub>) [.025, .477]<sup>3</sup> (see the left-side of Fig. 1).

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<sup>3</sup> The reported 95% CIs for effect sizes of ANOVAs ( $\eta^2$ ) and *t*-tests (Cohen's *d*) were computed by the MBESS package for R.

282 Specifically, the commitment-confirming effect of costly pro-relationship behaviors was greater  
283 than that of non-costly pro-relationship behaviors regardless of relationship type. Thus,  
284 Hypothesis 1 was supported.

285 Although the main effect of relationship type was not significant,  $F_{1, 154} = 0.45$ , *ns*, the  
286 interaction effect between relationship type and cost was significant,  $F_{1, 154} = 7.55$ ,  $p = .007$ , 95%  
287  $CI_{\text{effect size}} [.025, .125]$ . A post hoc test (Ryan test) revealed that costly pro-relationship behaviors  
288 were equally effective in confirming the strength of commitment in both friendship and romantic  
289 relationships, while non-costly pro-relationship behaviors were marginally more commitment-  
290 confirming in the friendship condition than in the romantic relationships condition.

### 291 3.2.2. Part B

292 To test Hypothesis 2, we presented participants with 11 scenarios that depicted a  
293 friend's/romantic partner's failures to perform situationally appropriate pro-relationship  
294 behaviors. The 11 anticipated damage scores were submitted to a multivariate analysis of  
295 variance (MANOVA) with the relationship type as the independent variable. The effect of  
296 relationship type was significant,  $F_{11, 143} = 7.22$ ,  $p < .001$ ,  $\eta_p^2 = .36$ .

297 After confirming the significant effect of relationship type in the omnibus test, a series of  
298 separate *t*-tests were conducted. As shown in the left-side of Fig. 2, the anticipated damage  
299 scores were greater in the romantic relationships condition than in the friendship condition for 10  
300 out of 11 failure scenarios. Six hypothesis-consistent differences were significant:  $t_{155}$  [95% CI  
301 of Cohen's *d*] = 3.25 [.20, .84], 2.27 [.05, .68], 2.86 [.14, .78], 8.14 [.96, 1.65], 3.68 [.27, .91],  
302 and 3.73 [.28, .92] for the failures to provide instrumental support, provide emotional support,  
303 listen to a partner's problem, remember a special occasion, engage in activities with a partner,  
304 and visit a sick/injured partner, respectively. These results support Hypothesis 2.

## 305 **4. Study 2**

306           The purpose of Study 2 was to replicate the findings of Study 1 using a large cross-  
307 cultural (i.e., American) sample with a full between-participants design.

### 308 *4.1. Method*

309           Participants were 534 American users of Amazon's Mechanical Turk, also known as  
310 MTurk (359 females, 175 males;  $M_{AGE} \pm SD = 35.30 \pm 11.98$  years). MTurk is an online  
311 crowdsourcing service, increasingly used in psychological research, which has been shown to  
312 produce valid data (Buhrmester, Kwang, & Gosling, 2011; Mason & Suri, 2012). Of the 534  
313 participants, 115 participants (22%) indicated they were currently single, while 419 participants  
314 (78%) indicated they were currently in a relationship, most of whom (219 participants, 41% of  
315 the total sample) were married. Twenty one participants (4%) reported that they had never been  
316 involved in a romantic relationship. Excluding these 21 participants did not change the reported  
317 results. Following Mason and Suri's (2012) recommendation, only MTurk users with a task  
318 completion approval rate of 90% and above were allowed to participate in this study. Participants  
319 took an average of 6 minutes and 12 seconds to complete the survey, and were paid 20 cents  
320 each for their participation.

321           In Study 2, the two conditions in Part A (relationship type and cost) were between-  
322 participants factors. In addition, Part A and Part B were administered to separate samples. Thus,  
323 Part B involved only the relationship type condition (friendship vs. romantic relationships) as the  
324 between-participants factor.

325           The scenarios used in Study 2 were similar to those in Study 1 (see Tables A1 and A2 in  
326 Appendix). However, they were edited to be appropriate for a non-student American sample. In

327 addition, the costly scenarios and non-costly scenarios were edited for a between-participants  
328 design.

#### 329 *4.2. Results and discussion*

##### 330 *4.2.1. Part A*

331 The six responses to the three pro-relationship scenarios (i.e., three scenarios  $\times$  two  
332 items) were internally consistent in both the costly and non-costly behavior conditions  
333 (Cronbach's  $\alpha$  was .85 and .79 in the costly and non-costly conditions, respectively). Again, the  
334 six scores were aggregated within each condition to produce a single measure of the positive  
335 effect on commitment.

336 We conducted a 2 (sex: female vs. male)  $\times$  2 (relationship type: friendship vs. romantic  
337 relationships)  $\times$  2 (cost: costly vs. non-costly) ANOVA, as the effect of sex was significant in  
338 Study 2. Females reported higher overall commitment-confirming effect than males (3.38 vs.  
339 3.28),  $F_{1, 354} = 4.172, p = .042, 95\% \text{ CI}_{\text{effect size}} [.025, .042]$ . However, this effect was small, and  
340 no interactions involving sex were significant, all  $F_{1, 354}$ 's  $< 2.00, p$ 's  $> .10$ . Supporting  
341 Hypothesis 1, the main effect of cost was significant,  $F_{1, 354} = 18.99, p < .001, 95\% \text{ CI}_{\text{effect size}}$   
342  $[.025, .100]$  (see the right-side of Fig. 1). This effect size was substantially smaller than that in  
343 Study 1 (i.e.,  $[.025, .477]$ ), suggesting that at least some of the effect of cost reported in Study 1  
344 may have been due to a contrast effect associated with the within-participant design. Unlike  
345 Study 1, there was no significant interaction between cost and relationship type,  $F_{1, 354} < 1$ . The  
346 lack of the interaction suggests that the correspondent interaction in Study 1 may be a culture-  
347 specific effect or an instance of Type I statistical error. Further replication studies in Japan are  
348 needed to determine the robustness of the interaction effect.

##### 349 *4.2.2. Part B*

350 To test Hypothesis 2, damage scores were submitted to a MANOVA with relationship  
351 type as the independent variable. As with Study 1, the effect of relationship type was significant,  
352  $F_{11, 160} = 7.75, p < .001, \eta_p^2 = .35$ . After confirming the significant effect of relationship type in  
353 the omnibus test, a series of separate *t*-tests were conducted. As shown in the right-side of Fig. 2,  
354 the anticipated damage scores were significantly greater in the romantic relationships condition  
355 than in the friendship condition for five out of 11 failure scenarios:  $t_{170}$  [95% CI of Cohen's *d*] =  
356 2.83 [.13, .73], 2.87 [.13, .74], 6.79 [.72, 1.35], 4.14 [.32, .94], and 5.10 [.47, 1.09] for the  
357 failures to provide emotional support, listen to a partner's problem, remember a special occasion,  
358 engage in activities with a partner, and visit a sick/injured partner, respectively. Barring just one  
359 failure scenario (i.e., failure to provide instrumental support), these are the same scenarios from  
360 Study 1, which were reported to be more detrimental in romantic relationships. These results  
361 support Hypothesis 2, and show a remarkable level of cross-cultural consistency.

## 362 **5. General Discussion**

363 The reported studies suggest that pro-relationship behaviors, whether costly or non-costly,  
364 serve to strengthen perceived partner commitment, and may thus act as commitment signals. The  
365 pilot Study revealed the existence of marked similarity in commitment-confirming episodes  
366 between friendship and romantic relationships. Part A of Studies 1 and 2 supported Hypothesis  
367 1: Costly pro-relationship behaviors are perceived as more effective signals of the actor's  
368 commitment than non-costly pro-relationship behaviors. However, this does not necessarily  
369 mean that non-costly behaviors were unimportant. To the contrary, Part B of Studies 1 and 2  
370 suggest that failures to engage in pro-relationship behaviors (irrespective of their cost) are more  
371 damaging to romantic relationships than friendship. Taken together, we conclude that people  
372 face a similar commitment problem in friendship and romantic relationships, and that they try to

373 solve this problem by assessing similar behaviors that signal partner commitment. Nonetheless,  
374 people are considerably more sensitive to the presence/absence of partner's commitment signals  
375 in the romantic context than in the friendship context.

376         This study also revealed the flexibility of human commitment signals. Although most  
377 species use a species-specific costly signal for a specific purpose, such as displaying a long tail  
378 to attract potential mates, humans can express commitment by engaging in various costly  
379 behaviors, such as giving gifts, performing self-sacrifices, and tolerating stresses imposed by a  
380 partner. This flexibility could be attributed to humans' ability to manipulate symbols. In other  
381 words, our signal-reading ability might allow us to assess each signal's costliness at some  
382 abstract level, and therefore, concrete manifestations of cost may not matter for humans. The  
383 various types of commitment signaling behaviors observed in the present study (the pilot study in  
384 particular) provided some support for this perspective. In addition, it is intriguing to examine  
385 cross-cultural variability. Although Studies 1 and 2 showed marked similarities between Japan  
386 and the U.S., we may find greater variability in commitment signals when a wider range of  
387 cultures (e.g., many traditional societies) are taken into consideration (Hruschka, 2010). Thus,  
388 this line of research can provide a basis for understanding both cross-cultural similarities and  
389 dissimilarities in the array of interpersonal rituals that communicate commitment.

390         A first limitation of this study was that we did not examine the effect of cost type. In  
391 particular, this study did not make any explicit distinction between financial costs and other  
392 types of cost, such as the consumption of time. Although financial sacrifice might be sometimes  
393 considered inappropriate in the context of intimate relationships (e.g., Robben & Verhallen,  
394 1994), whether cost type moderates the commitment-confirming effect of pro-relationship  
395 behaviors should be investigated in future studies. Secondly, in the present study, failures to

396 engage in pro-relationship behaviors were operationally defined as the absence of behaviors in  
397 situations where they are appropriate. However, more subtle cases might arise where a partner  
398 incurs a moderate cost even though a more costly option was available (e.g., when Jessie gives  
399 Jordan a cheap bouquet of wildflowers instead of more expensive roses). Finally, as this study  
400 employed vignettes, it was unable to examine effects of non-verbal implicit cues, such as  
401 physical distance (Pentland, 2008), on perceived partner commitment. Combinations of various  
402 methods (e.g., experimental manipulations, retrospective recalls, and observations of structured  
403 and/or unstructured interactions) will allow us to attain a more comprehensive understanding of  
404 human commitment signals.

405         The present study explored how people come to know the degree to which their partner,  
406 be it a friend or a lover, is committed to the relationship. Theoretically, this study represents an  
407 attempt to answer the evolutionary question of how people solve the commitment problem (i.e.,  
408 how we reduce uncertainty about our partners' intentions to remain loyal). Practically, we hope  
409 this line of investigation will foster our understanding of the function of commitment signaling in  
410 promoting healthy and stable interpersonal bonds.

**411 Acknowledgement**

412           We thank Hitomi Kuranaga, Daisuke Nakanishi and Kunihiro Yokota for their generous  
413 support in the data collection. We are also grateful to Miho Iwasaki, Hitomi Sakaue, Shiori  
414 Tamada, Kanako Tanaka and Fumiaki Tanimoto for their help in data coding. Our gratitude is  
415 also extended to Daniel Nettle, Aaron Goetz, and an anonymous reviewer for their insightful  
416 comments on earlier versions of this article. This research was supported by the Japan Society  
417 for the Promotion of Science (Grant no. 21683006).

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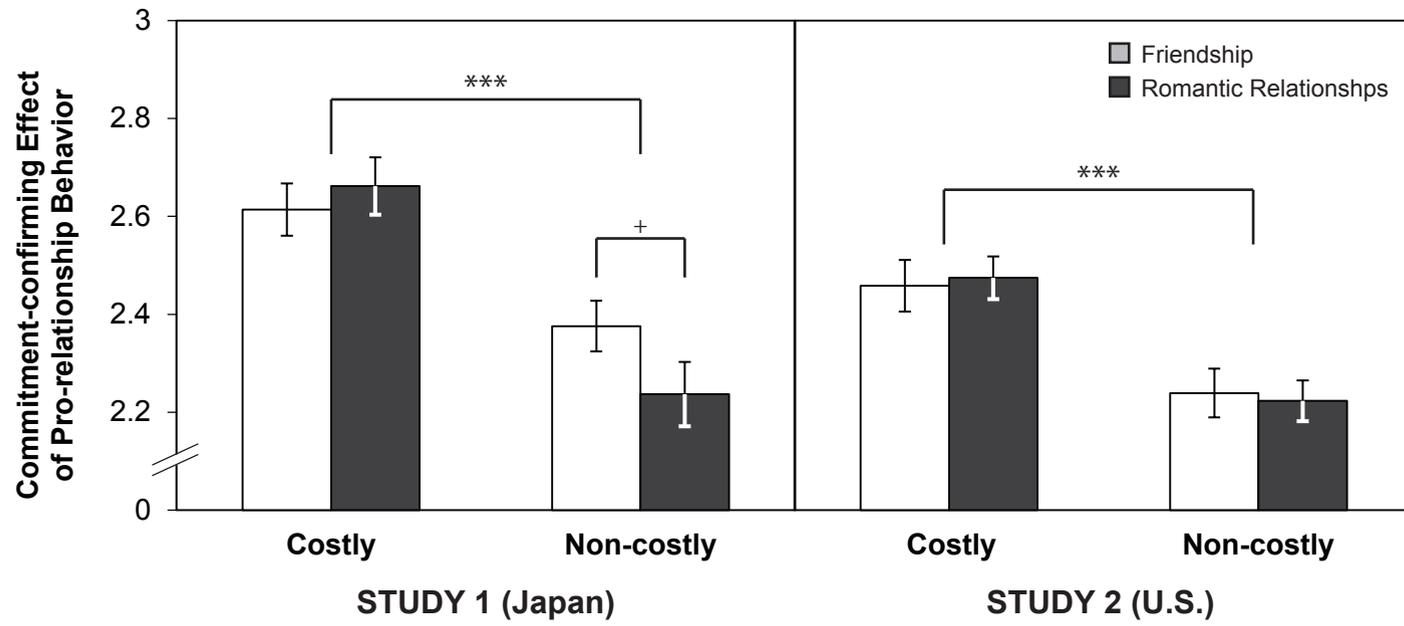
**Figure Captions**558 **Fig. 1.** Mean effectiveness of pro-relationship behaviors as a function of costliness of the

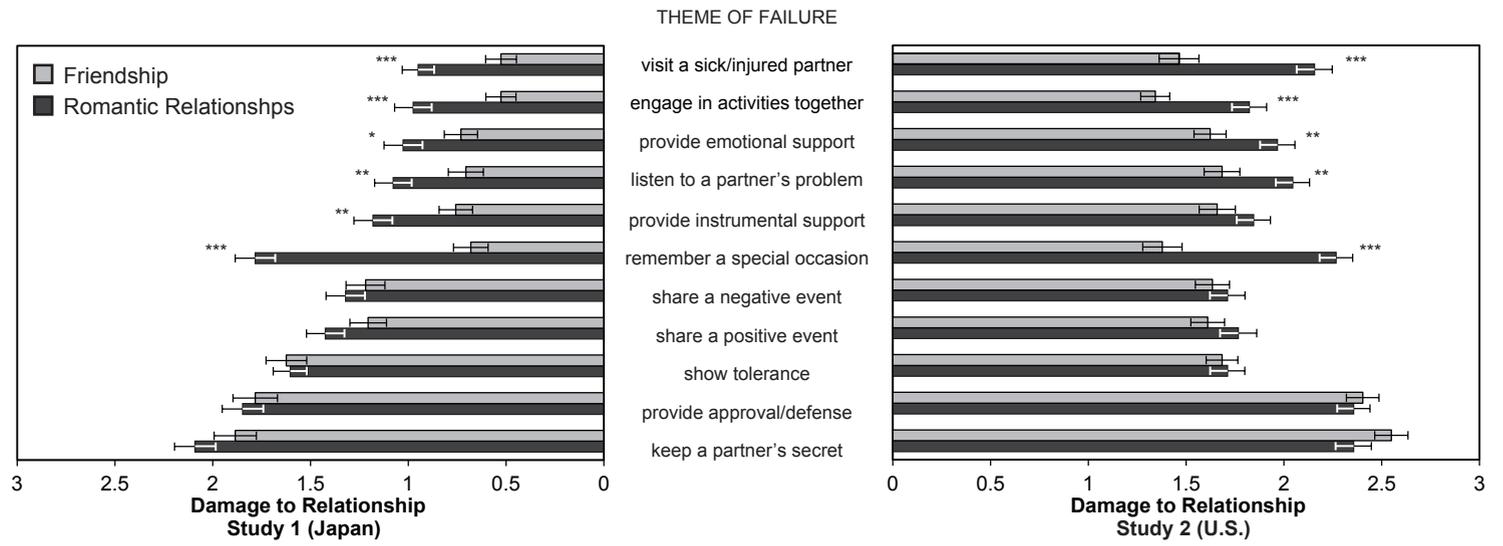
559 behaviors, relationship type, and country.

560

561 **Fig. 2.** Detrimental effect of failure to engage in various types of pro-relationship behaviors as a

562 function of scenario, relationship type and country.





### Supplementary Online Materials

#### **Commitment Signals in Friendship and Romantic Relationships**

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#### **Data Coding in Pilot Study**

In the pilot study, participants were asked to describe episodes in which two partners' bond was strengthened. The descriptions provided by the participants were coded and analyzed as follows.

##### *Episode coding*

Two participants reported no episodes. The remaining 162 participants provided at least one description. Thirty-seven participants provided multiple descriptions. Six coders independently determined the number of episodes included in each of these 37 descriptions. The coders reached consensus on the numbers of episodes for 21 descriptions. For the remaining 16 descriptions, the coders were unable to reach a consensus, and we discarded these 16 descriptions. Based on this initial screening procedure, 199 separate episodes (103 episodes about friendship and 96 episodes about romantic relationships) were retained for the subsequent analyses. Since a vast majority of participants (86%) reported only one episode, the 199 episodes were treated as independent observations. There was an exceptional participant who reported 14 separate episodes. Excluding this participant's episodes from the data set did not change the general pattern of the results.

The first author (MY) read through the episodes and identified 11 frequently described themes as described in the main text. The first author then coded all the 199 episodes in terms of the presence/absence of each of the 11 themes. Four naïve assistants (two males and two

females) then independently coded the episodes (each rater coded approximately half of the episodes). This coding procedure resulted in three sets of data (i.e., the first author's data, the male raters' data, and the female raters' data). For each episode, to compute the inter-rater agreement score, the number of agreed episodes was divided by the total number of the episodes (i.e., 199). The inter-rater agreements were reasonably high: The agreements between the male pair and female pair on each of the 11 themes ranged from .73 to .99. More importantly, their judgments were mostly in agreement with the first author's judgments. The agreement scores ranged from .81 to .99 for the first author and the male pair, and from .74 to .99 for the first author and the female pair. Given these high agreement scores, the first author's data were used in the subsequent analyses (Table 1 lists this first author's data). Using only the data which the three sets of coders agreed upon did not change the general pattern of the results.

#### *Costliness of the episodes*

The first author and another naïve male assistant read through all episodes. They independently determined whether each episode involved any cost. In particular, an episode was considered as being costly if it met at least one of the following three criteria: the actor spent some money (e.g., purchasing a gift), the actor spent a substantial length of time for the partner, the actor engaged in some self-sacrifice (e.g., giving up some desirable activities or running a risk of being injured). In determining whether an episode would meet these criteria, only explicit descriptions were counted. For example, "the partner listened to my problem *for a long time*" met the second criterion, while "the partner listened to my problem" did not. The agreement between the coders was .82, and we used the first author's coding for the reported analyses. Using the data which both coders agreed upon did not alter the reported results.