

Is there a Sunk Cost Effect in Committed Relationships?

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Abstract The sunk cost effect occurs when a prior investment in one option leads to a continuous investment in that option, despite not being the best decision. The aim of the present paper was to study the role of the sunk cost effect in committed relationships. In Experiment 1, participants ($N = 902$) were presented with an unhappy relationship scenario in which they needed to make a choice: to stay or end the relationship. Results showed that the likelihood of participants staying in the relationship was higher when money and effort, but not time, had been previously invested in that relationship. In Experiment 2, the time investment was manipulated and the sunk cost was evaluated using a different methodology. Specifically, instead of having a dichotomous decision, participants ($N = 275$) choose how much time they would be willing to invest in the relationship. Results revealed a sunk *time* effect, that is, participants were willing to invest more time in a relationship in which more time had already been invested.

Keywords Sunk cost effect · Time · Effort · Money · Committed relationships

Every day individuals have to make decisions about a variety of issues and, in many of these choice situations, deliberate in terms of costs and benefits. Imagine that you have decided to go to the cinema to watch a movie, about which you had high expectations, and you paid \$6 for the ticket. However, mid-way through the movie you are increasingly bored and, even

though you have made a great effort to stay for the last hour, the movie is not what you expected. Would you leave the movie theater? The answer is probably “No”. We could argue that his choice was being influenced by your past investment in terms of money, time, and effort watching the movie, therefore biasing your decision to stay until the end. This dilemma is called the sunk cost effect (Arkes 1996; Arkes and Ayton 1999; Arkes and Blumer 1985). What about if you were in an unhappy committed relationship? Would you leave or would you stay? The aim of the present study is to understand whether the sunk cost effect influences this decision.

The sunk cost effect occurs when a prior investment of money, effort, or time leads to a continuous investment in a failing path of action when the logical response would be to stop investing (Arkes and Blumer 1985). This is considered an irrational economic behavior because only future costs and benefits, not past costs, should influence decision making (Bornstein and Chapman 1995) because past investments cannot be undone. In the situation described above, the rational behavior would be to leave the movie theater and use the time for a walk, or other more pleasant activity, instead of staying until the end of the movie due to the previous investment.

This effect has been documented in several studies with humans (Arkes and Blumer 1985; Bornstein et al. 1999; Coleman 2009; Cunha and Caldieraro 2009; Moon 2001; Navarro and Fantino 2007, 2009; Staw and Fox 1977) and nonhuman animals (Macaskill and Hackenberg 2012; Magalhães and White 2013, 2014; Navarro and Fantino 2005). The sunk cost effect has also been observed in a variety of contexts and with different methodologies, as well as in laboratory (Keasey and Moon 2000; Moon 2001) and field settings (Arkes and Blumer 1985; Staw and Hoang 1995).

As evidenced by the literature, the sunk cost effect is a very pervasive phenomenon and several explanatory theories to explain it have arisen over the years. For example, according

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to the prospect theory (Kahneman and Tversky 1979, 1984; Tversky and Kahneman 1981, 1986) people are loss averse and individuals tend to value more losses compared with gains so they tend to commit more resources into a losing course of action, even after negative outcomes. An alternative explanation, self-justification, predicts that people invest the most amount of resources to a losing course of action when they are personally responsible for negative past outcomes (Staw and Fox 1977). This means that a higher personal responsibility for an initial decision results in a higher degree of sunk cost effect. In fact, receiving negative feedback about participants' own initial investment seems to escalate the amount of the additional commitment of resources to the initial option (Staw and Fox 1977). Another possible explanation for the sunk cost effect is wasteful avoidance (Arkes and Ayton 1999; Arkes and Blumer 1985), in which the effect occurs due to people's desire of not wanting to appear wasteful. In fact, most of us follow the rule "waste not, want not" since childhood. Finally, another possible explanation for the sunk cost effect could be that committing to a course of action is a form of promoting self-control and, hence, preventing impulsivity (Rachlin 2000).

Research has also shown that children tend to commit more to the sunk cost effect than adolescents (Klaczynski & Klaczynski and Cottrell 2004) and that younger adults are more likely than older adults to commit this error (Strough et al. 2008). In addition, men tend to commit more to the sunk cost effect when compared with women (Carpenter et al. 2005). However, despite these socio-demographic differences, the majority of individuals commit this error (Carpenter et al. 2005).

Single- and Multiple-Response Studies

The majority of the studies on the sunk cost effect are single-response studies (e.g., Arkes and Blumer 1985; Bornstein et al. 1999; Braverman and Blumenthal-Barby 2012). In these studies, each participant reads a scenario and has to make a single choice, i.e. a single response, between continuing with a course of action in which an investment has been made and changing to an alternative option. In these studies, a sunk cost effect is evidenced by participants choosing to stay with the option in which they had already made an investment despite a better alternative being available.

Similar to single-response studies are multiple-response studies, also known as escalation of commitment (e.g., Coleman 2009, 2010; Staw and Fox 1977). In both single- and multiple-response studies participants read a hypothetical scenario and have to make a choice between a losing course of action, in which a prior investment has been made, and a better alternative. The difference between multiple- and single-response scenarios is that the former are longer due to having

numerous moments in which participants have to decide whether they continue investing resources into that option or not. Usually, each moment of the scenario begins with a summary about the state of the investments and provides feedback about outcomes resulting from participant's prior options. In the escalation of commitment, participants repeatedly allocate resources to a losing option despite negative feedback.

Studies with Real Investments in Terms of Time, Effort, or Money

Alternatively to the scenario-based studies, researchers have devised more ecological procedures in which participants invest real time, effort, or money in a task (behavioral tasks), and have successfully observed the sunk cost effect (e.g., Cunha and Caldieraro 2009; Navarro and Fantino 2007, 2009). For example, Navarro and Fantino (2007) used a computer task in which participants could earn hypothetical money by pressing a key a variable number of times or, alternatively, press another key to terminate the trial and start a new one. The number of key-presses to obtain money was different in each round and sometimes the optimal choice was to press the escape key without earning any money (e.g., if they had to press the money-key more than 10 times). The results showed that participants persisted in the course of action, continuing to press the money-key when quitting was the optimal choice. In this study, although the reward obtained was hypothetical, the effort invested in the course of action was not; hence, the study is considered ecological because real effort was invested. Navarro and Fantino (2009) conducted other studies in which participants invested real time to complete a jigsaw puzzle with a short or long time investment. Participants were provided with the option of staying longer in the task and try to finish the puzzle, or to abandon the activity. The results suggested a sunk cost effect as participants in the short-time investment condition were more likely to abandon the task than participants in the long-time investment condition, who invested more in completing the puzzle.

Cunha and Caldieraro (2009) also observed a sunk cost effect using a computer behavioral task in which participants viewed a list of products (electronic gadgets) and their task was to rate the products and select the best one based on those ratings. However, at the moment of choice, a new product with a better rating was presented and participants had to choose whether they wanted this new and better option or whether they preferred to stay with the prior choice. There were two effort conditions that varied in the level of effort to select the product (high-effort and low-effort), and two levels of how much better the new product was when compared with the first option (slightly better or much better). Results showed that participants in the high-effort task were more likely to stay with their first option than participants in the low-effort task

when the new product was slightly better. This result is consistent with the sunk cost effect because their initial investment in that first option predisposed them to continue with their initial choice. When the new product was much better than the initial option both groups equally opted for the new and better option. Studies involving real investments show that when people invest real time, or effort, in a course of action the investment is taken into account and individuals have a higher probability of remaining in the original course of action despite a better option being available.

A classical study conducted in a more ecological setting was that of Arkes and Blumer (1985) in which real money was expended in one of their experiments. Three types of season theater tickets for the Ohio University Theater were sold: normal price (\$15), low discount (\$13 after a \$2 discount from the original price), and high discount (\$8 after a \$7 discount from the original price). Because the three types of tickets were sold randomly to the students, we would expect that, on average, there would be no difference between groups in terms of number of plays attended to by the buyers. Results showed, however, that students who bought the normal price ticket attended to more plays in the first six months of the season than those who bought the discount ticket. In other words, a higher monetary investment in money led participants to watch more plays than those who bought the tickets with a discount. It is unlikely that this result could be attributed to students who value plays more being more likely to purchase tickets at full price because the discount was assigned randomly to the tickets. Therefore, the results suggested a sunk cost effect.

Another ecological study was conducted by Staw and Hoang (1995). These authors evaluated the playing time of basketball players (NBA), which was not determined by their performance, but rather by their initial cost to the team. More specifically, players had more time in the court, had longer NBA careers, and were less likely to be traded to other teams based on how high their initial draft number was. These results hold after authors controlled for other variables, such as performance or injuries.

The Influence of the Context on the Sunk Cost Effect

All the aforementioned studies have been useful to demonstrate that the sunk cost effect is influenced by the context. For example, Bornstein et al. (1999) studied choices made by medical residents on medical and non-medical situations that varied in the amount of prior investment. Although the medical residents' evaluation of the treatment decisions was not influenced by the amount of resources already invested in that treatment, they demonstrated a sunk cost effect when evaluating non-medical situations by being influenced by the prior investments. This result was corroborated in a study with

health care providers (Braverman and Blumenthal-Barby 2012). In this study, four hypothetical clinical scenarios, differing only in the origin and type of previous investments in the treatment plan, were used: 1) without any prior investment; 2) time investment by the health provider; 3) money investment by the patient; or 4) both types of prior investment (time investment by the health provider and money investment by the patient). Results showed that participants choose not to continue with a treatment that was not being effective in all conditions. Therefore, they did not show the sunk cost effect. Similarly, in a study with petroleum geologists using a hypothetical oil-drill scenario, Garland et al. (1990) found that participants were not influenced by prior investment.

Although counterintuitive to what would be expected with the sunk cost effect, there is evidence, as the described above, that individuals are less prone to commit this logical error in domains that are related to their area of expertise. That is, doctors are less likely to commit the sunk cost effect in questions related to medical decisions than questions related to any other topic.

In another study, Fennema and Perkins (2008) were interested in analyzing whether formal education could reduce the occurrence of the sunk cost effect. In their study, they had a group of participants that was trained to ignore sunk costs (e.g., MBA students), and another group that was not (introductory psychology students). They found that those participants that had knowledge in economics were less prone to commit the sunk cost effect. In other words, knowledge about sunk costs can prevent making this error.

The Influence of Sunk Costs in Intimate Relationships

Although the majority of the studies involve economic examples, it should not be ignored that there are several *nonmonetary sunk costs* that may influence decisions, including those incurred in personal relationships. During intimate and committed relationships people make daily investments (Goddard 2007). When facing a dilemma between continuing an unhappy relationship and finishing it, it is possible that these past investments bias individuals' decisions. To the best of our knowledge, there has been only two empirical studies relating the sunk cost effect and intimate relationships (Coleman 2009; Goodfriend and Agnew 2008).

More specifically, Coleman (2009) investigated the influence of earlier, irrecoverable investments on commitment to an online date arranged in a computer simulation. The simulation contained separate screens describing a hypothetical scenario on searching for a potential date in an online dating website. Participants invested one of five amounts of effort into the selection process (negligible, low, moderate, high, or maximum), and then had to choose whether they wanted to

attend the date arranged online or attend a superior blind date that was presented at the moment of choice. Results showed an effect of sunk cost on commitment to first dates arranged online. In other words, participants showed a tendency to continue with the date arranged online despite the alternative blind date being a better option, as the candidate date had more features (or attributes) that were closer to the ideal partner of the participant.

Regarding Goodfriend and Agnew's (2008) study, the focus was on investments that differ in terms of timing (past vs. planned) and materiality (tangible vs. intangible). Tangible investments were material resources that would lose value if the relationship ended (e.g., house), whereas intangible investments were nonphysical resources that would lose value if the relationship ended (e.g., love). More specifically, the study analyzed different types of investments and how they may be associated with relationship outcomes. The authors showed that both tangible investments and intangible investments are associated with relationship commitment and stability. In addition, they found that intangible investments and planned investments were particularly good predictors of relationship state and fate.

Our Study

Taken together, these studies (Coleman 2009; Goodfriend and Agnew 2008) suggest that the sunk cost effect may play a role in the committed relationships domain. However, Coleman (2009) focused on the investments when trying to arrange an online date, and not on an already established intimate relationship. In addition, Goodfriend and Agnew (2008) compiled all the tangible investments in one category (e.g., pets, house, possessions, objects, debts) and the intangible investments in another category (e.g., effort, time, emotional ties, self-disclosures, sacrifices, intellectual life, and sense of identity). Therefore, it was not possible to analyze the impact that each investment had on an intimate relationship. As a consequence, it is important to extend the research on the effects of the sunk costs in the intimate relationship domain.

The past few decades have witnessed an increase in the divorce rate in diverse countries, with recent demographic data showing that within the EU-28 there are 2 divorces for every 1000 persons (Eurostat Statistics Explained 2016). The divorce has a dramatic impact not only on each member of the couple, but also on the entire family, particularly on the children (Kalmijn 2015; Weaver and Schofield 2015). The question of why intimate relationships succeed or fail have been the focus, over the last decades, of many evolutionary, social, and clinical psychology researchers, as well as anthropologists and neuroscientists (Huston 2009). Therefore, knowing more about the reasons that lead a couple to remain together is of crucial importance.

The main purpose of the current study is, therefore, to understand whether investments in terms of time, effort, or money, influence people's decision to stay in, or leave, an unhappy marriage. These three variables were selected as they are among the most analyzed in previous studies in the economic domain (Navarro and Fantino 2007, 2009). Specifically regarding time, considering that in a relationship a substantial amount of the investment is made in terms of time, and that the sunk time effect is difficult to obtain in other domains, it is important to explore its role in the committed relationship's domain. For example, in one of the most systematic studies about the *sunk time* effect, Soman (2001) proposed three reasons for why time is different from money. First, as opposed to money, it is not possible to inventory or replace time; secondly, it is not easy to aggregate time; and finally, it is not a routine activity to account for time. Results from Soman's research have highlighted the relevance of these assumptions (please see Soman's Experiment 4 in which the sunk time effect was only obtained when a wage rate was provided, highlighting the difficulty of accounting for time compared to the task of accounting for money).

The aim of Experiment 1 is to investigate whether investments in terms of money, effort, or time affect people's decisions to stay or leave an unhappy marriage. Experiment 2 will explore the sunk cost effect when time has been invested using a different methodology.

Experiment 1

Aim

The major goal of Experiment 1 was to investigate whether the sunk cost effect influences people's decision to stay in, or leave, an unhappy marriage. Authors hypothesized that more past investments in the relationship in terms of time, effort, and money would bias participants to choose to continue with the relationship. Additionally, authors wanted to analyze whether there is an association between committing the sunk cost effect in the committed relationships domain and demographic characteristics of the individuals.

Method

Participants Participants ($N = 1251$) were recruited via University of Minho's institutional email and were asked to complete a questionnaire on an internet webpage using Qualtrics software, Version 2013 of the Qualtrics Research Suite (www.qualtrics.com). Two hundred and ninety-nine participants were excluded from the analysis because they did not complete the survey; that is, these participants started but did not finish the survey. Of the 952 participants (Table 1) that voluntarily completed the survey, 309 were randomly

Table 1 Demographic characteristics of the sample by condition (Experiment 1)

Variable	Control group n (%)	Time group n (%)	Money group n (%)	Effort group n (%)
Gender				
Female	221 (71.5)	183 (70.9)	118 (79.2)	160 (67.8)
Male	88 (28.5)	75 (29.1)	31 (20.8)	76 (32.2)
Age				
18–25	256 (82.8)	207 (80.2)	139 (93.3)	192 (81.4)
26–32	34 (11)	35 (13.6)	9 (6)	32 (13.5)
>33	19 (6.2)	16 (6.2)	1 (0.7)	12 (5.1)
Nationality				
Portuguese	300 (97.1)	253 (98.1)	144 (96.6)	229 (97.1)
Other	9 (2.9)	5 (1.9)	5 (3.4)	7 (2.9)
Relationship				
Yes	222 (71.8)	170 (65.99)	92 (61.7)	174 (73.7)
No	87 (28.2)	88 (34.1)	57 (38.3)	62 (26.3)
Has been betrayed?				
Yes	96 (31.1)	91 (35.3)	48 (32.2)	69 (29.2)
No	213 (68.9)	167 (64.7)	101 (67.8)	167 (70.8)
Already betrayed someone?				
Yes	44 (14.2)	53 (20.5)	30 (20.1)	50 (21.2)
No	265 (85.8)	205 (79.5)	119 (79.9)	186 (78.8)
Sexual Orientation				
Heterosexual	282 (91.3)	239 (92.6)	139 (93.3)	223 (94.5)
Homosexual	13 (4.2)	8 (3.1)	3 (2)	6 (2.5)
Bisexual	14 (4.5)	11 (4.3)	7 (4.7)	7 (3)

assigned to the *control* condition (mean age = 23.10; $SD = 5.77$), 258 to the *time* condition (mean age = 23.14; $SD = 5.54$), 149 to the *money* condition (mean age = 21.59; $SD = 2.91$), and 236 participants to the *effort* condition (mean age = 23.29; $SD = 5.38$). There were significant differences between mean age of the participants in the *money* condition and all the other conditions (for all F 's, $p < .05$). Specifically, participants in the *money* condition were younger than participants in the other three conditions. There were no age differences between participants in the other groups (Table 1).

Design and Procedure Initially, participants responded to some demographic questions; namely age, gender, nationality, sexual orientation, whether they were in a relationship, how long they have been in that relationship, the kind of relationship (e.g., marriage, casual, dating), and whether they have ever betrayed a partner or whether they have ever been betrayed. Then, each participant was asked to read only one of four scenarios and answer a yes/no type of question. The four conditions differed in the type of investment made by the participant. For the experimental groups, the investments

could be in terms of time (*time condition*), money (*money condition*), and effort (*effort condition*) invested in the hypothetical situation described. The fourth condition served as control group. For the *control* scenario, participants read:

“Imagine that you have been married for the past 10 years with your partner, and that in the last few months you have been feeling unhappy with your relationship. For example, little things turn into big discussions and you feel that you can no longer communicate with your partner. You have not had sexual relations, for a few months now, and you stay at work after hours to delay the moment to return home. Due to this problem with your partner you feel lost and distressed and believe you would be happier if you were no longer in that relationship.”

What would you do:

- (1) *Finish the relationship*
- (2) *Continue the relationship*

The *time* condition differed from the control condition only in the duration of the marriage; instead of 10 years participants read 1 year.

In the *money* condition, a final sentence was added to the control scenario, suggesting that the participant had made an investment in terms of money to maintain the marriage: *“During your relationship, you invested all your money in buying a house with your partner and you are currently living in a stable economic situation.”*

Finally, for the *effort* condition a different final sentence was added to the control scenario, suggesting that the participant had made an investment in terms of effort to maintain the marriage: *“You have made a huge effort to change this situation, including talking to your partner, spending more time with him/her, and surprising him/her.”*

Data Analysis The percent of participants influenced by the sunk cost effect was measured according to the different types of investment (control, time, money, or effort). Sunk cost percent refers to the percent of individuals that indicated that they would stay in the relationship. Then, to evaluate if the difference between the proportions of occurrence of the sunk cost effect for each group compared to the control group was significant, z -ratios were calculated. Finally, the association between the sunk cost effect and participants' demographic characteristics (e.g., gender or age) was calculated. All significance tests were two-sided and values of 0.05 level represented significant differences. Statistical software was used for Descriptive Statistics and Analytical Statistics (*Chi-Square Test*, X^2 ; *Fisher's Exact Test* or *Point – Biserial Correlation Coefficient*, r_{pb}).

Results

Results showed that in the *control* condition 25.89% ($n = 80$) of the participants opted to continue in the relationship (Fig. 1). In the *time* condition 25.97% ($n = 67$) opted to continue, whereas in the *money* condition 35.57% ($n = 53$) opted to continue, and in the *effort* condition 36.86% ($n = 87$) opted to continue with the relationship.

There are no differences between the *control* and *time* conditions in the occurrence of the sunk cost effect ($z = 0.021$, $p > .05$), whereas for the *money* condition compared with the *control* condition there are differences in the occurrence of the sunk cost effect ($z = 2.138$, $p < .05$). Finally, there are differences between the *effort* and *control* conditions in the occurrence of the sunk cost effect ($z = -2.754$, $p < .01$).

Table 2 presents a summary of the results relevant to the question of whether committing the sunk cost effect is associated with the demographic characteristics of the participants. Results show that there is a significant association between gender and committing the sunk cost effect, only for the *money* condition, $X^2(1) = 11.299$, $p = .001$. Specifically, after a money investment, males (61.3%) preferred to continue with the relationship, whereas a smaller number of females (28.8%) opted to continue the relationship. Additionally, participants who were currently in a relationship demonstrated a tendency to persist with the relationship; that is, to commit the sunk cost effect. Importantly, there was a significant association between being in a relationship and committing the sunk cost effect, i.e. for the *control* ($X^2(1) = 6.059$, $p = .014$), *money* (Fisher's Exact Test = .020), and *effort* conditions (Fisher's Exact Test = .046). For the remaining demographic variables, and in all conditions, there were no statistically significant associations (see Table 2).

Discussion

The major finding from this experiment is that, in fact, prior investments biases individuals to persist in a relationship when

they are in an unhappy relationship, despite a better choice being available. These findings are consistent with the authors' hypothesis for the money and effort conditions, but not for the time condition. The present results are in line with studies that reported a sunk cost effect for money (e.g., Arkes and Blumer 1985) and effort (e.g., Navarro and Fantino 2009) in other contexts, and provide evidence for the sunk cost effect in committed relationships domain. Additionally, prior research has found it difficult to obtain the sunk cost effect when there has been an investment in terms of time (e.g., Soman 2001), a difficulty also existent in the present study.

Additionally, men seem to be more prone to commit the sunk cost effect than women when a monetary investment was present. This result is consistent with findings by Carpenter et al. (2005). Another interesting finding was that being in a relationship enhanced the likelihood of committing sunk cost in the committed relationships' domain.

However, it cannot be ignored that there was no evidence for the *sunk time* effect. Because prior studies (e.g., Navarro and Fantino 2009) have reported a sunk time effect in other contexts, it was further investigated whether it is possible to obtain this effect in the committed relationships' domain. To accomplish that, a different methodology from that employed in Experiment 1 (a single-response method with a dichotomous decision) was used in Experiment 2.

Experiment 2

Aim

Considering the failure to observe a sunk cost effect for the time condition in Experiment 1, the major goal of Experiment 2 was to investigate whether a sunk time effect could be obtained in the committed relationships' domain using a different methodology from that used in Experiment 1. As in Experiment 1, there was also the plan to analyze possible associations between committing the sunk time effect in the relationships domain and demographic characteristics of the individuals.

Method

Participants Similarly to Experiment 1, participants ($N = 1160$) were recruited via University of Minho's institutional email, and were asked to complete an online questionnaire on Qualtrics. Of the initial sample, 885 participants had to be excluded from the analysis because they did not complete the survey ($N = 486$, 54.92%) or because they had already responded to Experiment 1 ($N = 399$, 45.08%). Of the 275 participants (Table 3) that voluntarily completed the survey, 150 were randomly assigned to the *1 year* condition (mean age = 25.79; $SD = 7.11$), and 125 to the *10 years*

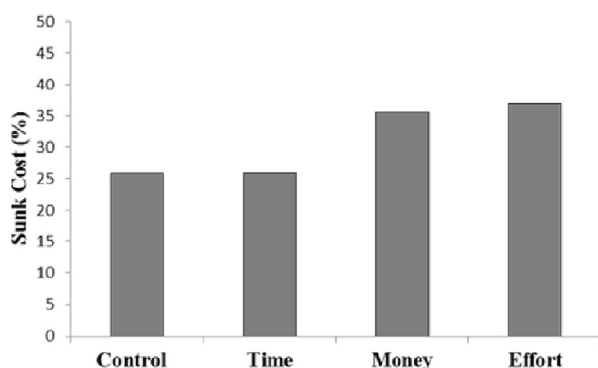


Fig. 1 Percentage of the members of each group who chose to end the relationship

Table 2 Proportion of Sunk Cost and statistical significance according to demographic characteristics and by condition (Experiment 1)

Variable	Control group			Time group			Money group			Effort group		
	Continue n (%)	Finish n (%)	Statistical Significance	Continue n (%)	Finish n (%)	Statistical Significance	Continue n (%)	Finish n (%)	Statistical Significance	Continue n (%)	Finish n (%)	Statistical Significance
Gender												
Female	56 (25.3)	165 (74.7)	Fisher's Exact Test $p = .774$	47 (25.7)	136 (74.3)	X^2 $p = .870$	34 (28.8)	84 (71.2)	X^2 $p = .001$	53 (33.1)	107 (66.9)	Fisher's Exact Test $p = .112$
Male	24 (24.5)	64 (75.5)		20 (26.7)	55 (73.3)		19 (61.3)	12 (38.7)		34 (44.7)	42 (55.3)	
Age												
18–25	62 (24.2)	194 (75.8)	r_{pb} $p = .114$	57 (27.5)	150 (72.5)	r_p $p = .733$	50 (36)	89 (64)	r_{pb} $p = .457$	71 (37)	121 (63)	r_{pb} $p = .598$
26–32	11 (32.4)	23 (67.6)		6 (17.1)	29 (82.9)		3 (33.3)	6 (66.7)		13 (40.6)	19 (59.4)	
>33	7 (36.8)	12 (63.2)		4 (25)	12 (75)		0 (0)	1 (100)		3 (25)	9 (75)	
Nationality												
Portuguese	75 (25)	225 (75)	X^2 $p = .359$	66 (26.1)	187 (73.9)	X^2 $p = .858$	51 (35.4)	93 (64.4)	X^2 $p = .174$	85 (37.1)	144 (62.9)	X^2 $p = .630$
Other	5 (55.6)	4 (44.4)		1 (20)	4 (80)		2 (40)	3 (60)		2 (28.6)	5 (71.4)	
Relationship												
Yes	66 (29.7)	156 (70.3)	X^2 $p = .014$	39 (22.9)	131 (77.1)	Fisher's Exact Test $p = .136$	39 (42.4)	53 (57.6)	Fisher's Exact Test $p = .020$	71 (43.3)	103 (56.7)	Fisher's Exact Test $p = .046$
No	14 (16.1)	73 (83.9)		28 (31.8)	60 (68.2)		14 (24.6)	43 (75.4)		16 (25.8)	46 (74.2)	
Has been betrayed?												
Yes	25 (26)	71 (74)	Fisher's Exact Test $p = 1.000$	23 (25.3)	68 (74.7)	Fisher's Exact Test $p = .883$	18 (37.5)	30 (62.5)	X^2 $p = .734$	21 (30.4)	48 (69.6)	Fisher's Exact Test $p = .235$
No	55 (25.8)	158 (74.2)		44 (26.3)	123 (73.7)		35 (34.7)	66 (65.3)		66 (39.5)	101 (60.5)	
Already betrayed someone?												
Yes	9 (20.5)	35 (79.5)	X^2 $p = .374$	12 (22.6)	41 (77.4)	X^2 $p = .535$	8 (26.7)	22 (73.3)	X^2 $p = .254$	13 (26)	37 (74)	X^2 $p = .073$
No	71 (26.8)	194 (73.2)		55 (26.8)	150 (73.2)		45 (37.8)	74 (62.2)		74 (39.8)	112 (60.2)	

Please note that significant findings are in bold

Table 3 Demographic characteristics of sample by condition (Experiment 2)

Variable	1 Year group n (%)	10 Years group n (%)
Gender		
Female	106 (70.7)	89 (71.2)
Male	44 (29.3)	36 (28.8)
Age		
18–25	99 (66)	86 (68.8)
26–32	27 (18)	19 (15.2)
>33	24 (16)	20 (16)
Nationality		
Portuguese	145 (96.7)	118 (94.4)
Other	5 (3.3)	7 (5.6)
Relationship		
Yes	124 (82.7)	102 (81.6)
No	26 (17.3)	23 (18.4)
Has been betrayed?		
Yes	67 (44.7)	41 (32.8)
No	83 (55.3)	84 (67.2)
Already betrayed someone?		
Yes	34 (22.7)	17 (13.6)
No	116 (77.3)	108 (86.4)
Sexual Orientation		
Heterosexual	144 (96)	121 (96.8)
Homosexual	2 (1.3)	2 (1.6)
Bisexual	4 (2.7)	2 (1.6)

condition (mean age = 25.54; $SD = 8.13$). There were no significant differences in the participants age between the 1 year condition and the 10 years condition [$t(273) = .26$, $p = .792$].

Design and Procedure Each participant completed only one scenario. After responding to some demographic questions (the same as in Experiment 1), participants read a short scenario, but instead of having a dichotomous decision (staying or leaving the relationship), they choose how much time they would be willing to invest in the relationship. To do that, a

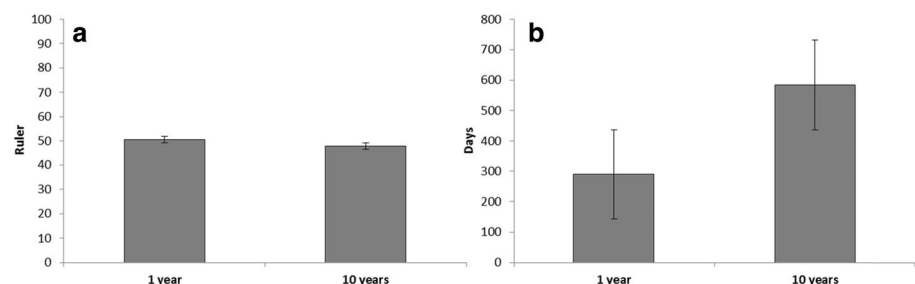
ruler labeled with “no time” to “a lot of time” on its edges was used and participants were asked to select a location in between the edges of the ruler (the ruler also ranged from 0 to 100, each associated with the labels “no time” and “a lot of time”, respectively). That location would represent how much time participants would be willing to invest in that relationship. Next, participants were asked to specify how much time that location in the ruler corresponded to in days, weeks, months, or years. The scenario for the control group was the same as the control scenario of Experiment 1 (“Imagine that you have been married for the past **10 years** with your partner”). The scenario for the experimental group was similar, but instead of 10 years, participants could read 1 year (“Imagine that you have been married for the past **1 year** with your partner...”). A question at the end of the questionnaire was added regarding whether participants had previously participated in a similar experiment, namely, Experiment 1. Participants that had already participated in a similar experiment were excluded from the analysis.

Data Analysis When participants responded how much time they were willing to invest in that relationship in terms of days, weeks, months, or years, results were all converted into days. Associations between sunk time effect and participants’ demographic characteristics (e.g., gender or age) were analyzed. Similarly to Experiment 1, a statistical software was used for Descriptive Statistics and Analytical Statistics (*Student’s T-Test*, *t*; *Pearson Correlation*, *r*, or *Point – Biserial Correlation Coefficient*, r_{pb}).

Results

The mean results for each condition and with both the ruler- and days-measures are presented in Fig. 2. Results from the ruler-measure (that ranged between 0 and 100) show that, in the 1 year condition, participants were willing, on average, to invest 50.51 ($SD = 29.17$) and, in the 10 years condition, participants were willing to invest 47.82 ($SD = 32.45$). There were no significant differences between the two conditions relatively to the ruler-measure ($t(273) = .721$, $p = .741$). In contrast, results from the days-measure revealed significant effects of *sunk time*. In the 1 year condition, participants were willing to

Fig. 2 Sunk Time in the two investment conditions, 1 year and 10 years. Panel **a** shows the results of the ruler-measure by condition. Panel **b** shows the results of the days-measure by condition. Error bars represent standard errors of the mean



invest 289.02 days ($SD = 257.02$) and, in the *10 years* condition, participants were willing to invest 583.87 days ($SD = 1389.45$), being this difference statistically significant ($t(273) = -.255, p = .011$).

Similarly to Experiment 1, correlations between *sunk time* (in both ruler- and days'-measures) and demographic characteristics of the individuals was calculated (Table 4). Results show that there is a significant association between age and the sunk time effect for both the *1 year* ($r = .173, p = .034$) and *10 years* conditions ($r = .236, p = .008$), but only for the days-measure. This means that the older the participants are, the more days they were willing to invest in that relationship. For the remaining socio-demographic variables, and in all conditions, there were no significant associations (see Table 4).

Discussion

Results of Experiment 2 were consistent with the initial hypothesis, i.e. a higher prior investment in terms of time biases participants to invest more time in that relationship. However, the hypothesis was only confirmed when participants responded in terms of days, not for the ruler-measure.

Particularly, a prior investment in time, in the relationship, biased the participants to invest more days in that relationship. Prior studies have already reported a *sunk time* effect in other contexts (e.g., Navarro and Fantino 2009), and the results from this experiment provide evidence for the *sunk time* effect in the committed relationships' domain.

Regarding the possible associations between demographic characteristics and the sunk cost effect, previous research has demonstrated that younger adults are more likely than older adults to be influenced by the sunk cost effect (Strough et al. 2008). However, our results seem to demonstrate the opposite. That is, in a committed relationship's domain, the older the participants the more likely they are to persist in a relationship, in which a prior investment in time has been made. Nevertheless, this result must be read with caution: the age range of the participants in the present study is very narrow and the experiment was not designed to test for possible age effects on the likelihood of committing the sunk cost effect.

General Discussion

The main purpose of the present study was to understand whether the sunk cost effect influences an individual's

Table 4 Mean Sunk Time and statistical significance according to demographic characteristics and by condition (Experiment 2)

Variable	1 Year condition				10 Years condition			
	Ruler Mean (SD)	Statistical Significance	Days Mean (SD)	Statistical Significance	Ruler Mean (SD)	Statistical Significance	Days Mean (SD)	Statistical Significance
Gender								
Female	50.51(29.17)	$r_{pb} = .100$ $p = .224$	289.02(257.02)	$r_{pb} = -.140$ $p = .087$	47.77(32.57)	$r_{pb} = -.022$ $p = .807$	582.69(1395.02)	$r_{pb} = .010$
Male	50.83 (29.39)		294.99(259.83)		47.68 (32.54)		585.64(1394.94)	$p = .910$
Age								
18–25	50.89(29.15)	$r = -.038$ $p = .641$	291.71(257.68)	$r = .173$ $p = .034$	47.77(32.57)	$r = -.102$ $p = .258$	582.69(1395.02)	$r = .236$ $p = .008$
26–32	50.44(29.21)		291.51(257.85)		47.85(32.83)		590.01(1411.46)	
>33	50.99(29.65)		298.29(262.52)		48.49(32.44)		601.15(1426.66)	
Nationality								
Portuguese	50.51(29.17)	$r_{pb} = .104$	289.02(257.02)	$r_{pb} = .027$	47.82(32.45)	$r_{pb} = .053$	583.87(1389.45)	$r_{pb} = .021$
Other	51.43(28.86)	$p = .205$	308.05(275.02)	$p = .745$	54.28(33.21)	$p = .557$	688.05(1417.02)	$p = .820$
Relationship								
Yes	50.51(29.17)	$r_{pb} = -.028$	289.02(257.02)	$r_{pb} = .053$	47.68(32.54)	$r_{pb} = -.074$	585.64(1394.94)	$r_{pb} = -.111$
No	51.24(29.44)	$p = .734$	299.85(265.21)	$p = .517$	47.58(32.78)	$p = .412$	588.52(1405.64)	$p = .218$
Has been betrayed?								
Yes	50.54(29.28)	$r_{pb} = -.070$	293.08(258.02)	$r_{pb} = -.071$	47.97(32.91)	$r_{pb} = .094$	597.49(1415.65)	$r_{pb} = .077$
No	50.51(29.17)	$p = .394$	289.02(257.02)	$p = .390$	47.91(32.57)	$p = .298$	589.32(1400.04)	$p = .394$
Already betrayed someone?								
Yes	50.20(29.65)	$r_{pb} = -.005$ $p = .953$	292.584(260.28)	$r_{pb} = -.088$ $p = .282$	49.87(32.93)	$r_{pb} = .036$ $p = .689$	643.89(1490.88)	$r_{pb} = .021$ $p = .812$
No	50.89(29.15)		291.71(257.68)		47.82(32.45)		583.87(1389.45)	

Please note that significant findings are in bold

decision to stay or leave an unhappy intimate relationship. To accomplish this aim, in Experiment 1 participants read a hypothetical scenario and had to decide whether they would stay or leave an unhappy relationship, in which they had made prior investments (either in terms of time, money, or effort). In Experiment 2 there were only time scenarios and, instead of a yes/no type of answer, participants chose how much time they would be willing to invest in the relationship. This was done with two types of measure, in a ruler and in days. In both experiments, evidence for a sunk cost effect would be participants selecting to continue with the relationship, or allocating more time in a relationship, in which a higher prior investment had been made.

Time, Money and Effort Investments

Together, both experiments confirmed the initial hypothesis that investments in terms of time, effort, and money make individuals more prone to stay and invest in a relationship in which they are unhappy. This option was chosen when – and taking into consideration how unhappy the person was in that relationship – the logical decision would be to finish the relationship, independently of the prior investments. The results obtained in Experiment 1 provided evidence that past investments in a relationship, in terms of effort and money, bias individuals to continue with a relationship under bad circumstances. Furthermore, results from Experiment 2 showed that a higher prior investment, in terms of time, biased the participants to invest more time in that unhappy relationship. That is, despite not finding evidence for the *sunk time* effect in Experiment 1, there was evidence for the sunk time effect in Experiment 2 with the days-measure.

In fact, present results are consistent with previous research in which obtaining a sunk time effect has proven difficult (Soman 2001). However, how can the present results be integrated in Soman's explanations, considering that participants were not provided with a monetary equivalent for time? The scenario presented in both experiments for the time condition was exactly the same; what differed was the participant's task. In Experiment 1, participants had to choose between continuing and finishing the relationship. Whereas in Experiment 2, participants had to quantify, in a "ruler" and then in "days", how much they were willing to invest in the relationship. As Soman suggested, accounting for time is not a routine activity and that could help explain why in Experiment 1 and Experiment 2, with the ruler-measure, we did not observe a sunk time effect. In contrast, providing information in terms of days is a much more tangible unit, which could have facilitated the task of accounting for time. Additionally, a yes/no type of question may not be the most sensible measure to evaluate willingness to continue to invest in an activity, as it requires a definite decision. In contrast, when the question is formulated in terms of "days", besides being more tangible for the

participants, it is not a definite decision. Due to its characteristics, *time* is perhaps the most unique unit and the only that is present every day in our lives regardless of the context. Results from the present study are intriguing, and confirm the need of conducting more studies in the sunk cost domain with *time* investments in different contexts and employing different methodologies.

Relationship Status, Gender and Age: their Impact on the Sunk Cost Effect

Regarding the associations between the sunk cost effect and some demographic characteristics of the individuals, data from Experiment 1 showed that there was a significant relation between being in a relationship and committing the sunk cost effect for the *control*, *money*, and *effort* conditions. Additionally, results showed that men were more prone to commit the sunk cost effect than women when a prior monetary investment was presented. In Experiment 2, there was a significant association between age and *sunk time* effect, in both the *1 year* and *10 years* conditions. These results suggest that some demographic variables could enhance the likelihood of committing the sunk cost effect in the context of intimate relationships.

Age is a demographic variable widely studied in the context of the sunk cost effect (e.g., Klaczynski & Klaczynski and Cottrell 2004; Strough et al. 2008), yet there is no study about the relation between age and the sunk cost effect in intimate and committed relationships domain. In addition, since there is only one study (Carpenter et al. 2005) relating the sunk cost and demographic variables (like gender), there is a call for a broader and more robust cross-cultural study covering all demographic variables, not only in the committed relationships domain but also in other domains (e.g., business).

Regarding the current study, it is important to note that participants in the money condition were younger than participants in the effort and control conditions and, as noted before, there is a relationship between age and sunk cost, with younger adults being more likely to commit this error than older adults (Strough et al. 2008). However, it was previously highlighted that the sunk cost effect in the current study was also observed in the effort condition, in which participants were older.

Limitations and Future Research

One limitation of the present study is that some participants may have felt that leaving the relationship was the worse choice, as they could imagine they had nowhere to go or were afraid of abandonment. Collecting this type of information could help formulate, or corroborate, a theory that explains the sunk cost effect in the committed relationships domain. The power of past investments in the relationships

domain should be a future research goal. In addition, another limitation of the present study is the age of the majority of our participants, which ranged from 18 to 25 years. It would be interesting to investigate if the same pattern of results would be obtained with an older sample. This would contribute to make our findings more generalizable. Another limitation of the current study was the use of a scenario-based design. Future studies could also explore the sunk cost effect in the relationships domain using different methodologies, such as multiple-response scenarios or more ecological methodologies, like studying the sunk cost effect in couples who are receiving marriage counseling. For example, our results are consistent with those of Skerrett and Fergus (2015), who showed that the “we-ness” is a crucial component of resilient relationships, consisting of a couple’s shared investment in each other and the extent to which they act in the best interest of their relationship. The sunk cost effect in traditional economic/psychological studies assumes a rational decision made solely on the basis of a cost/benefit analysis. However, in committed relationships there is (presumably) an emotional component, which not found in traditional experiments that might bias respondents’ decisions. Future research should also investigate the effect of emotions on the participant’s decision-making. Culture can also have an important impact on behavior and previous research has shown the existence of cultural differences on sunk cost bias (Yoder et al. 2014). Therefore, it would be interesting to investigate the cultural component in the sunk cost effect in intimate relationships, as some of the results might have been affected by cultural factors. This could also contribute to the generalizability of the results. Another interesting question could be the possible influence of sunk costs in abusive relationships; or to study, from the individual’s point of view, the reasons why he/she persists with his/her relationships. In other words, it would be interesting to have the participants clearly state the reasons why they decided to leave, or stay in, the relationship. This is particularly important because the future value of the alternative option is always unknown. For example, when a divorce occurs, individuals may be in a worse economic situation, not necessarily because they have invested financially in the relationship.

Conclusion

The sunk cost effect is widely studied but little attention has been devoted to the committed relationships context. The present study is the first to show evidence of a sunk cost effect when someone is involved in an intimate and committed relationship. Past investments in terms of time, effort, and money influence an individual’s decisions to persist in a relationship when facing a dilemma between continuing an unhappy relationship and finishing it. Results can have implications for

several domains, such as couples’ therapy. By showing that investments in the relationship, regarding time, effort, and money, lead to a higher motivation to stay in the relationship, our study suggests that promoting these investments in a couple in a clinical setting can help contributing to better therapeutic outcomes.

Compliance with Ethical Standards

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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