



Life-domain regret regarding procrastination (LDR-P): Scale validation in the United States and Israel

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Published online: 8 February 2018

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Abstract

Life regrets over inactions were found to have a long-term negative effect on people's lives. Procrastination can be considered as a type of inaction; however, life regret regarding procrastination has been only briefly studied. The present study examined the factorial structure of the life-domain regret regarding procrastination scale (LDR-P) in two cultures (the US and Israel). In addition, the associations of regret regarding procrastination with general and behavioral procrastination measures and its mean scores were compared between the two cultures. Findings indicated a four-factor structure (*career & community, interpersonal relationships, personal development, self-enhancement*) based on the presence of procrastination in different life-domains. Further findings revealed strong associations between regret regarding procrastination and the two other procrastination measures mainly for the US sample. Finally, a comparison of factors means between the US and Israeli samples indicated that Americans more than Israelis experience regret over procrastination in education, career planning, finance and community life-domains. These results suggest both that life-domain regret regarding procrastination is a multi-dimensional construct that can be measured in different cultures and detect some cross-cultural differences. It should be further studied to better understand if and how it affects peoples' lives, and how it can be addressed.

Keywords Life-domains · Regret · Procrastination · Culture · Validation

Most people are familiar with the painful feelings of regret resulting from the negative consequences of a bad action or a poor decision. A chronic tendency to experience regret is consistently correlated with lower subjective happiness and with higher depression and can interfere with learning and future decision-making (Reb and Connolly 2009). Roese and Summerville (2005) showed that people's biggest life-domain regrets were a reflection of where in life they observed their largest opportunities for change, growth, and renewal. Other studies indicated that regrets of inaction seem to last longer than regrets of action, in part, because they reflect a greater perceived opportunity (Morrison and Roese 2011). Interestingly, although procrastination can be considered one of the most studied types of inaction, regret regarding procrastination in general and in different life-

domains has been only briefly studied (Ferrari et al. 2009; Kuhnle et al. 2011; Pittman et al. 2008). Ferrari et al. (2009) suggested that missing an opportunity to decide or act because of engaging in procrastination might result in feelings of regret. They studied life-domain regret in chronic procrastinators and found that chronic procrastinators experience more regret than non-procrastinators in 6 of 12 life-domains. Pittman et al. (2008) discussed the option that anticipated regret mediates the relationship between missed opportunity and further procrastination, and Kuhnle et al. (2011) suggested that students would procrastinate less as a way to avoid feelings of regret. These findings highlight the need to further examine regret regarding procrastination in order to better understand the dynamics underlying this phenomenon and how to address it.

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Regret

Regret is often defined as an unpleasant, counterfactual, self-focused emotion that results from having made an unfavorable choice (Roese and Summerville 2005). In counterfactual thinking, the actual is compared to the imagined possible,

resulting in negative feelings arising from the post-decisional thought of the decision maker that estimates that his position would have been better had he chosen differently (Halpern and Leung 2015). As a negative emotional experience, regret is believed to be subject to regulatory mechanisms that serve to limit its sting but also to direct behavior toward fixing what evoked the regret (Epstude and Roese 2008).

The vast majority of research on regret has focused on the effects of anticipated and perceived regret regarding consumer decision making (Gilbert et al. 2004), the distinction between regret pertaining to action and inaction and the missed opportunity and correction effects of regret (Beike et al. 2009). Further studies have indicated that the tendency to regret is linked to lower levels of life satisfaction and happiness and to higher levels of depression, guilt, and disappointment (Berndsen et al. 2004; Schwartz et al. 2002; Zeelenberg et al. 2000).

Regrets concerning education and work in particular had a negative impact on life satisfaction, and self-related regrets were associated with depressive symptoms (Jokisaari 2004). The ability to resolve and come to terms with life regrets has been shown to contribute to better well-being for adults across all ages (Dijkstra and Barelds 2008; Torges et al. 2008). In a meta-analysis, Roese and Summerville (2005) proposed that opportunity breeds regret and found that Americans' six biggest regrets fall into the following life-domains: *education, career, romance, parenting, self-improvement, and leisure*. Further findings showed that when an older sample of Americans was studied (non-college students), the most intense life regrets were in *romance* and *family*, followed by *career, education, finance* and *parenting* (Morrison and Roese 2011).

Still in the framework of regret regulation theory, Beike et al. (2009) argued that the intensity and prevalence of life-domain regret was not affected by future opportunities for corrective actions (Roese and Summerville 2005) but rather by missed opportunities. People regret outcomes that could have been changed in the past but can no longer be changed and for which people experience low psychological closure (Beike et al. 2009). These authors found that people experienced most regret in the following life-domains: *health, finance, self-improvement, family* and *education*, followed by lower levels of regret in *parenting, romance, spirituality, community, friends, career* and *leisure*. Finally, Morrison et al. (2012) proposed that for non-college students, the regret in social-based life-domains is more intense because they are judged which constitute threats to belonging.

Most people believe that feelings of regret would be stronger for actions than for inactions. However, studies showed that young, middle-aged, and older adults from the United States as well as from several other cultures tend to recall more

regrets of inaction than regrets of action when asked to recall regrets accumulated throughout life (Gilovich et al. 2003; Schwartz et al. 2002). Gilovich and Medvec (1995) suggested that regrets of inaction and action might have different temporal patterns, as people may regret their inactions more so in the long term or regret their actions more so in the short term. Gilovich et al. (1995) argued that regrets of inaction are more psychologically "open" and imaginatively boundless, whereas regrets of action are psychologically fixed by their factual status and have only one alternative (not doing it). Thus, regrets of inaction seem to last longer than regrets of action, in part, because they reflect a greater perceived opportunity; however, intensity levels of both action and inaction regrets seems to be similar and fade very slowly over time (Beike and Crone 2008; Feldman et al. 1999; Roese and Summerville 2005).

Procrastination and Regret

Interestingly, although procrastination can be considered as one of the most studied types of inaction, due to the tendency to delay decisions and actions, the relationship between regret and procrastination has been only briefly studied (Ferrari et al. 2009; Kuhnle et al. 2011; Pittman et al. 2008). Procrastination is often defined as the "voluntarily delay of an intended course of action despite expecting to be worse off for the delay" (Steel 2007, p. 66). It is considered as a personality characteristic or a behavioral tendency that affects an individual's life across settings and situations (Ferrari 2010). The recent literature on procrastination shows that as many as 20–25% of normal, healthy adult men and women in the United States and in other countries around the globe are classified as chronic procrastinators (Argiropoulou and Ferrari 2015; Ferrari et al. 2007). In academic settings, the prevalence of procrastination is reported to be much higher (Steel and Klingsieck 2016). Further studies show that people procrastinate in the workplace and when seeking a job (Nguyen et al. 2013; Senecal et al. 2003), in conducting health related behaviors (Sirois 2015), in preparing for retirement (O'Donoghue and Rabin 2001), and in bedtime and sleep behaviors (Kroese et al. 2014). Recently, Klingsieck (2013) examined procrastination in six different life-domains, including *academic* and *work, everyday routines* and *obligations, health, leisure, family* and *partnership*, and *social contacts*. Her findings indicated that procrastination can be considered domain specific and more typical for the *academic* and *work, everyday routines* and *obligations*, and *health* domains than for the *leisure, family* and *partnership*, and *social contacts* domains (Klingsieck 2013).

Overall, procrastination has been found to be associated with some negative affective experiences, such as depressed mood, anxiety, shame, guilt and low levels of well-being (Beutel et al. 2016; Fee and Tangney 2000). Many other psychological states, including social anxiety, forgetfulness, disorganization, non-competitiveness, dysfunctional impulsivity, behavioral rigidity, and lack of energy, and lower states of self-confidence and self-esteem were also found to be positively associated with procrastination (Ferrari and Landreth 2014; Ferrari et al. 2005; Rice et al. 2012). Interestingly, although most definitions of procrastination entail the presence of discomfort, or the expectation of being worse off for the delay (Ferrari 2010; Steel 2010), feelings of regret have not been specifically studied in relation to procrastination.

Pittman et al. (2008) discussed the option that anticipated regret would mediate the relationship between missed opportunity and further procrastination. Ferrari et al. (2009) suggested that chronic procrastination might often result in people failing to act either because they cannot make up their mind (indecision) or because they wait to take action until it is too late and that this failure might result in feelings of regret. Using the life-domain regret (LDR) inventory (Roese and Summerville 2005), Ferrari et al. (2009) measured life-domain regret and procrastination in 2887 adults from across the United States. Based on previous research that found procrastination to be related to a variety of negative outcomes (Steel 2007), these authors expected that chronic procrastinators will report higher levels of life-domain regret, in comparison to non-procrastinators. Their findings indicated that chronic procrastinators reported significantly regret more, rather non-procrastinators in the domains of *education pursuits, parenting, family and friend interactions, health and wellness, and financial planning*. No significant differences in the feelings of regret were found between chronic procrastinators and non-procrastinators in *romance, career planning, spiritual and self-improvements*. Interestingly, these authors also noticed that arousal procrastinators reported significantly more regret than avoidant procrastinators in some life-domains. Overall, these findings are preliminary, but strongly suggest that the association between regret and procrastination should be further explored in general and in different life-domains specifically.

The Current Study

Following the above literature, that indicates the long-term negative consequences of regrets of inaction, the prevalence of procrastination as a type of inaction in most life-domains and the absence of studies on the relationship between these two constructs, the main objective of this study was to

evaluate a newly developed measure of regret regarding procrastination in different life-domains. Following Ferrari et al. (2009), we used Roese and Summerville's (2005) Life-Domain Regret (LDR) measure that included twelve categories. Each category represents a life-domain (family, friends, leisure, health, finances, career, education, self-growth, spirituality, community, parenting, and romance) in which participants report whether they experience regret or not. Each life-domain is followed by example (e.g., Career: jobs, employment, earning a living ("If only I were a dentist") or Health: exercise, diet, avoiding of treating stress ("If I only could stick to my diet"). Roese and Summerville (2005) used each one of the twelve categories to represent a life-domain in which a person may experience regret. Further, Ferrari et al. (2009) converted this measure into a Likert-scale questionnaire asking participants to indicate to what extent they experience regret regarding each one of twelve life-domains (from 1 = *a little regret* to 5 = *a lot of regret*). In addition, they used a measure of general procrastination and examined the associations between these two variables.

In the present study, to specifically measure procrastination-related regrets in different life-domains, we modified the items of Ferrari et al. (2009) questionnaire. For example, instead of asking about regret concerning an "educational degree and studying", we asked about "procrastinating in attaining an educational degree and studying" or instead of regret about "financial decisions/investments", we asked about "procrastinating in making financial decisions/investments". Unlike Ferrari et al. (2009) that measured separately life-domain regret and procrastination, we directly asked respondents to reflect on their regret regarding procrastinating in each life-domain. This direct manner of asking people about their delays characterizes most frequently used procrastination scales (Steel 2010).

Further, we validated our scale using general procrastination and decisional procrastination scales. Finally, in order to allow the cross-cultural generalizability of findings, usage of scales, and the overall detection of cross-cultural differences in regret regarding procrastination, we validated this scale cross-culturally (Boer and Fischer 2013; McCabe et al. 2008).

To conclude, our main goal was to adjust and evaluate an instrument for a measurement of regret regarding procrastination in different life-domains, and it led to the following research questions:

- (1) What is the factorial structure of the life-domain regret regarding procrastination (LDR-P) scale as documented by exploratory factor analysis (EFA)?
- (2) Is the factorial structure found in EFA valid for the US and Israeli samples?

- (3) Are English and Hebrew versions of the LDR-P scale equivalent as documented by measurement invariance across the US and Israeli samples?
- (4) Is the LDR-P scale a valid and reliable measurement tool as documented by discriminant and convergent validity and reliability testing?

Methods

Participants and Procedure

The US sample consisted of 2300 adults with ages that ranged from 25 to 67 ($M = 42.50$, $SD = 12.06$). Sixty-one percent of the sample was female; approximately 46% were single, 39% were married, and 12% were divorced or separated. Approximately 79% of the sample was Caucasian, and the rest were Asian (3%), African-American (3%), Indian (3%) or Hispanic (3%). Sixty-seven percent of the sample stated that they were employed, 22% were students, 5% were retired and 6% were unemployed.

Recruitment of participants was conducted through an online questionnaire disseminated by DePaul University, USA. The participation in data collection was voluntary and anonymous, and no incentives were offered for taking part in the research.

The Israeli sample consisted of 897 Jewish adults with ages that ranged from 25 to 70 ($M = 39.25$, $SD = 12.97$). Sixty-one percent of the sample was female; approximately 77% stated that they were married, 62% were employed, 12% were students, and 25% were employed and enrolled in school.

Recruitment of participants was conducted by an Israeli online data collection company, which employs a panel of over 100,000 participants representing the total Israeli Jewish population (www.ipanel.co.il). The questionnaires were translated by the first and the second authors using a back-translation method and then transformed into their online form using Qualtrics software (www.qualtrics.com). The recipients who received the link to the survey were first directed to a page containing an informed consent letter; they were required to provide their informed consent before proceeding to the survey itself.

Measures

To measure life-domain regret regarding procrastination (LDR-P) we adapted the life-domain regret (LDR) inventory (Ferrari et al. 2009; Roese and Summerville 2005). This instrument measures how much regret a participant has (from 1 = *a little regret* to 5 = *a lot of regret*) in different life areas: family, friends, leisure, health, finances, career, education, self, spirituality, community, parenting, and romance. For the

purposes of our research, we rephrased each item to measure a procrastination-specific regret. For example, instead of having regret concerning an “educational degree and studying”, we asked about “procrastinating on an educational degree and studying” or instead of regret about “financial decisions/investments”, we asked about “procrastinating on making financial decisions/investments”.

To test discriminant and convergent validity, we used the following measures:

- 1) The Adult Inventory of Procrastination (AIP; McCown et al. 1989), which is a 15-item, 5-point Likert scale (from 1 = *false for me* to 5 = *true for me*) that included items such as “I do not get things done on time” and “I am not good at meeting deadlines”. Previous studies reported that the AIP was a valid and reliable measure of behavioral procrastination with a Cronbach’s alpha reliability of .79–.83 and a test-retest reliability score of .71 (Ferrari 1994; Ferrari et al. 1995). For the current study, we used a composite score of AIP items with internal reliability values of .91 for the US sample and .81 for the Israeli sample.
- 2) The Decisional Procrastination Scale (DP, Mann 1982) consisted of five items on a 5-point Likert scale (1 = *false for me*; 5 = *true for me*). Previous studies reported a Cronbach’s alpha ranging from .71 to .80 and a one-month test-retest reliability of .69 (Effert and Ferrari 1989; Ferrari 1994). For the current study, we used a composite score of the DP items with internal reliability values of .90 for the US sample and .88 for the Israeli sample.

Data Analysis

The statistical analysis involved several steps. First, we calculated descriptive statistics of LDR-P items and presented effect sizes between the means of the items for our two samples. Second, to explore a factorial structure of LDR-P, we performed exploratory factor analysis (EFA). Third, we performed a series of validation tests of LDR-P:

- (1) To validate the structure found in the EFA, we performed confirmatory factor analysis (CFA) of the LDR-P for each sample separately and then performed a multiple group confirmatory factor analysis (MG-CFA) for both samples simultaneously.
- (2) To explore differences and similarities in the LDR-P structure between the two samples, we tested measurement invariance.
- (3) We conducted reliability tests using composite reliability and factor determinacy coefficients of internal consistency.

- (4) We tested discriminant validity by exploring the inter-correlation between LDR-P factors, and we tested convergent validity using an examination of correlations between LDR-P factors and two types of procrastination (behavioral, as measured by AIP, and decisional, as measured by DP).

Results

Descriptive Statistics

Descriptive statistics of LDR-P items are shown in Table 1. For the overall sample, it seems that *health*, *career*, *community* and *education* life-domains had the highest means, while *parenting* and *spirituality* life-domains had the lowest means. Exploring the means of each sample separately shows that in the US sample, participants had the most regret in *health*, *career*, *community* and *education* life-domains, with means of 3 or above, while *parenting*, *spirituality* and *leisure* life-domains had the lowest means. In contrast, in the Israeli sample, only the *health* life-domain had a mean above 3, while the *spirituality* life-domain had the lowest mean.

To give a sense to these differences and show the size of effects between the two samples, we also computed Cohen's *d* values (Cohen 1988). As seen from Table 1, for 10 of 12 items (except *parenting* and *leisure*), the US participants scored higher than Israeli participants did. The majority of effects in terms of effect size (*s*) were small. For items 1 (*career*) and 2 (*community*), these effects were medium.

Exploratory Factor Analysis

The US and Israeli samples were randomly split into two datasets of approximately equal sample size: a “training sample” ($N = 1624$, 72% participants from the US and 28% participants from Israel) and two “validation samples” ($N = 1146$ for the US sample and $N = 447$ for the Israeli sample). Exploratory factor analysis (EFA) with robust maximum likelihood (RML) estimation using an exploratory SEM (ESEM) procedure was performed on the training sample using MPLUS 7.4 (Muthén and Muthén 2015). The advantage of ESEM is that items can cross-load freely (like in EFA), but model fit (SEM) is also assessed (Mathieu et al. 2013). This approach also allows the exploration of the structure underlying a given construct and provides the best solution in terms of model fit. In our study, we compared factorial structures with one, two, three and four latent variables. Oblique Geomin rotation was chosen since the extracted factors were expected to correlate (see Table 2).

Conventional fit indices and thresholds were used to examine the goodness of fit of the model being analyzed: χ^2/df [1;4], the root mean square error of approximation (RMSEA) [0.05; 0.08], RMSEA 90% CI with its lower limit close to 0 and the upper limit below 0.08, probability level value of the tests of close fit (PClose) >0.50 , standardized root mean square residual (SRMR) [0.05;0.08], comparative fit index (CFI) and Tucker-Lewis Fit Index (TLI) [0.90;0.95] (Hu and Bentler 1999). In addition, we looked at Akaike Information Criterion (AIC) and at Bayesian Information Criterion (BIC) and searched for a model with the lowest values (Raftery 1995).

We extracted models with one, two, three and four factor solutions and compared them using a chi-square difference

Table 1 Means, standard deviations and Cohen's *d* effect size values for the LDR-P inventory data

Item	Overall sample ($N = 3197$)		US ($N = 2300$)		Israel ($N = 897$)		Cohen's <i>d</i>
	M	SD	M	SD	M	SD	
1 Career: jobs, employment, earning a living	3.16	1.27	3.34	1.30	2.70	1.18	0.52
2 Community: volunteer work, political activism	3.01	1.25	3.22	1.32	2.47	1.06	0.63
3 Education: school, studying, getting good grades	3.00	1.38	3.09	1.44	2.78	1.23	0.23
4 Parenting: interactions with offspring	2.27	1.17	2.20	1.18	2.44	1.13	0.21
5 Family: interactions with parents and siblings	2.70	1.23	2.73	1.28	2.61	1.11	0.10
6 Finance: decisions about money	2.93	1.34	3.00	1.41	2.75	1.17	0.19
7 Friends: interactions with close others	2.94	1.22	3.01	1.27	2.76	1.08	0.21
8 Health: exercise, diet, avoiding or treating illness	3.36	1.27	3.43	1.32	3.19	1.15	0.20
9 Leisure: sports, recreation, hobbies	2.73	1.25	2.63	1.30	2.97	1.12	0.28
10 Romance: love, sex, dating, marriage	2.93	1.37	3.01	1.42	2.74	1.23	0.20
11 Spirituality: religion, philosophy, the meaning of life	2.36	1.28	2.44	1.38	2.15	1.02	0.24
12 Self: improving oneself in terms of abilities, attitudes, behaviors	2.77	1.28	2.81	1.34	2.68	1.11	0.11

Table 2 Model fit indices of ESEM results from the training sample (N = 1624)

Model	χ^2	df	χ^2/df	p	RMSEA (90% CI)	PClose	CFI	TLI	SRMR	AIC	BIC
1 factor	438.22	54	8.12	<.001	0.07 (0.06; 0.07)	0.00	0.88	0.85	0.05	53,944.70	54,137.64
2 factors	310.19	43	7.21	<.001	0.06 (0.05; 0.07)	0.00	0.91	0.87	0.04	53,780.46	54,032.36
3 factors	200.71	33	6.08	<.001	0.06 (0.05; 0.07)	0.06	0.95	0.89	0.03	53,638.63	53,944.12
4 factors	68.46	24	2.85	<.001	0.03 (0.02; 0.04)	1.00	0.99	0.96	0.02	53,535.05	53,888.77
Model comparison	$\Delta \chi^2$	Δdf	p	ΔCFI							
2-factor vs. 1-factor	117.09	11	<.001	0.03							
3-factor vs. 2-factor	92.63	10	<.001	0.04							
4-factor vs. 3-factor	160.68	9	<.001	0.04							

test using the Satorra-Bentler scaled chi-square, which is an appropriate test for models with robust maximum-likelihood estimation (Bryant and Satorra 2012). These comparisons revealed that a model with four factors had the best fitting model factors ($\chi^2 = 438.22$, $df = 54$, $p < .001$, $RMSEA = 0.03$, $CFI = 0.99$, $TLI = 0.96$). Therefore, this four-factor model was subsequently tested by confirmatory factor analysis (CFA) and then by multiple-group confirmatory factor analysis (MGCFAs) using the second half of the US and Israeli dataset (validation samples), separately.

The factor structure of the four-factor model is presented in Table 3. To determine the appropriateness of the four-factor

model, we examined the standardized factor loadings using a cut-off ≥ 0.3 for item inclusion (Costello and Osborne 2009). As seen in Table 3, we received four distinguishable factors: all the items met the cut-off criterion, and there were no cross loadings. The first factor (*career & community*) consisted of items regarding regret about *career* (item 1) and *education* (item 3), which have the highest factor loadings, indicating that these two items represent Factor 1 the most, and *community* (item 2) and *finance* (item 6). The second factor (*interpersonal relationships*) included items regarding regret about *family* (item 5, the highest factor loading), *parenting* (item 4) and *friends* (item 7). The third factor (*personal development*) involved items regarding regret

Table 3 Standardized factor loadings and standard estimates of the four-factor model (N = 1624)

Item	M (SD)	Factor								
		Factor 1: Career & community		Factor 2: Interpersonal relationships		Factor 3: Personal development		Factor 4: Self-enhancement		
		Loading	SE	Loading	SE	Loading	SE	Loading	SE	
1 Career: jobs, employment, earning a living	3.17 (1.33)	0.67	0.05	-0.01	0.04	-0.01	0.05	-0.03	0.03	
2 Community: volunteer work, political activism	3.12 (1.33)	0.34	0.06	0.14	0.08	0.09	0.08	0.14	0.08	
3 Education: school, studying, getting good grades	3.01 (1.41)	0.61	0.08	0.06	0.07	0.01	0.05	0.02	0.06	
4 Parenting: interactions with offspring	2.66 (1.61)	-0.10	0.07	0.52	0.09	0.04	0.06	0.01	0.03	
5 Family: interactions with parents and siblings	2.73 (1.28)	0.02	0.02	0.75	0.08	-0.03	0.04	-0.01	0.02	
6 Finance: decisions about money	3.01 (1.38)	0.34	0.06	0.19	0.07	0.09	0.08	-0.01	0.02	
7 Friends: interactions with close others	3.01 (1.25)	0.07	0.07	0.41	0.09	0.22	0.09	0.02	0.05	
8 Health: exercise, diet, avoiding or treating illness	3.40 (1.30)	0.09	0.14	-0.03	0.06	0.65	0.14	-0.01	0.02	
9 Leisure: sports, recreation, hobbies	2.81 (1.31)	-0.12	0.12	0.04	0.06	0.82	0.07	-0.01	0.01	
10 Romance: love, sex, dating, marriage	2.98 (1.42)	0.10	0.08	0.18	0.09	0.32	0.08	0.07	0.05	
11 Spirituality: religion, philosophy, the meaning of life	2.38 (1.39)	-0.02	0.03	0.01	0.05	-0.01	0.02	0.93	0.32	
12 Self: improving oneself in terms of abilities, attitudes, behaviors	2.80 (1.31)	0.19	0.09	-0.01	0.07	0.18	0.13	0.36	0.21	
Correlations between factors										
		Factor 1	Factor 2	Factor 3	Factor 4					
	Factor 2	.49***	–							
	Factor 3	.53***	.60***	–						
	Factor 4	.32***	.47***	.45***	–					

Factor loadings in bold identify the factor to which the item was assigned * $p < .05$, ** $p < .01$, *** $p < .001$

about *leisure* (item 9, the highest factor loading), *health* (item 8) and *romance* (item 9). The last factor (*self-enhancement*) included two items: *spirituality* (item 11, the highest factor loading) and *self* (item 12). The inter-correlations between the LDR-P factors were moderate and ranged between .32 and .60, providing additional support for the multi-dimensional structure of LDR-P.

Validation of LDR-P

Construct Validity

To validate the factor structure found in EFA, we ran a confirmatory factor analysis (CFA) for each sample and then a multiple-group confirmatory factor analysis (MGCFA), where each group was a sample from our country of interest (the US or Israel). For this purpose, we used a second portion of each split sample (a validation sample).

The results of the CFA analysis produced the following results. For the US sample, $\chi^2(48) = 163.85$, $\chi^2/df = 3.41$, RMSEA = 0.05 [90% CI: 0.04; 0.06], PClose = 0.52, SRMR = 0.05, CFI = 0.92, and TLI = 0.90. For the Israeli sample, $\chi^2(48) = 106.11$, $\chi^2/df = 2.21$, RMSEA = 0.05 [90% CI: 0.04; 0.06], PClose = 0.61, SRMR = 0.06, CFI = 0.94, and TLI = 0.92. In addition, the results of the CFA provided acceptable standardized item loadings (i.e., $\lambda_{ij} \geq 0.30$, $p < .001$) (see Table 4). Overall, these results clearly provide support for the four-factor solution model found in the EFA.

Table 4 shows that there were some differences between the US and Israeli samples, although the general pattern was the same. The main difference can be seen in Factor 1 (*career & community*): for the US sample, items with the highest factor loadings were 1 (*career*) and 3 (*education*), while in the Israeli sample, the item with the highest factor loading was 6 (*finance*). Of course, these differences are descriptive only, and formal tests are needed to determine whether they

are statistically significant. These tests were performed following the steps suggested by Van de Schoot et al. (2012) and are described in the next section.

Measurement Invariance of LDR-P across the Samples

Testing measurement invariance is crucial in cross-cultural research addressing latent constructs. If we want to ensure that comparisons of models involving latent variables are valid across groups or time, we must establish some level of invariance (Milfont and Fischer 2015; Van de Schoot et al. 2012).

To assess measurement invariance, we tested three levels of invariance: configural, metric, and scalar (Steenkamp and Baumgartner 1998; Vandenberg and Lance 2000). Configural invariance is a test of weak factorial invariance in which the same pattern of factor loadings hold across groups (Vandenberg 2002). Configural invariance must be met for subsequent tests (i.e., metric, scalar invariance) to be meaningful. Metric invariance postulates that all factor loadings are equal across groups (Cheung and Rensvold 2002). If metric invariance is satisfied, factor covariance or unstandardized regression coefficients can be compared across groups (Steenkamp and Baumgartner 1998); the presence of metric variance indicates that the construct has the same meaning across the groups. Scalar invariance assumes that all item intercepts are the same across groups. To meaningfully compare groups and avoid biases that might be present even when satisfying metric invariance, scalar invariance is needed (Steenkamp and Baumgartner 1998). If scalar invariance is met, then latent means can be meaningfully compared across groups.

If metric or scalar invariance is not achieved, one can try to establish partial measurement invariance, which requires at least two loadings and intercepts that are equal across the groups. In this case, latent factor means can still be compared

Table 4 Results of the confirmatory factor analysis from US and Israeli validation samples (standardized factor loadings are presented)

	Item	US (N = 1146)			IL (N = 447)		
		Loading	SE	Intercept	Loading	SE	Intercept
Factor 1: Career & community	1	0.58	0.04	3.35	0.47	0.06	2.77
	3	0.61	0.04	3.05	0.52	0.05	2.94
	6	0.45	0.03	2.93	0.65	0.04	2.94
Factor 2: Interpersonal relationships	2	0.48	0.04	3.15	0.42	0.06	2.72
	5	0.6	0.04	2.68	0.66	0.05	2.78
	4	0.59	0.04	2.19	0.4	0.05	3.36
Factor 3: Personal development	7	0.68	0.03	2.94	0.72	0.04	2.84
	9	0.67	0.03	2.65	0.8	0.04	3.09
	8	0.61	0.03	3.39	0.72	0.05	3.33
Factor 4: Self-enhancement	10	0.55	0.03	2.97	0.53	0.06	2.94
	11	0.65	0.03	2.52	0.6	0.06	2.44
	12	0.78	0.03	2.8	0.74	0.05	2.78

across the groups, but not the sum scores (Byrne et al. 1989; Steinmetz 2013).

Model fit for configural, metric, and scalar invariance models is shown in Table 5. The configural model with the unconstrained factor loadings and intercepts had acceptable fit indices. For the subsequent model, metric invariance held, as indicated by nonsignificant chi-square difference tests and a ΔCFI smaller than .01 (Cheung and Rensvold 2002). However, scalar invariance did not hold, as shown by both significant chi-square difference tests and a ΔCFI larger than .01. Releasing intercepts of items 1 (*career*) and 2 (*community*) in *Factor 1 (career & community)*, item 4 (*parenting*) in *Factor 2 (interpersonal relationships)* and item 9 (*leisure*) in *Factor 3 (personal development)* led us to a model that did not differ significantly from the full metric invariance model, meaning that partial scalar invariance was achieved.

Reliability of LDR-P

To assess the reliability of the LDR-P factors, we calculated a composite reliability (CR), which is usually calculated in conjunction with structural equation modeling (Peterson and Kim 2013) and, in contradiction to Cronbach’s alpha, does not assume that all indicators have equal factor loadings (Hair et al. 2006). The CR values found for the US sample are as follows: .61 for *Factor 1 (career & community)*, .66 for *Factor 2 (interpersonal relationships)*, .64 for *Factor 3 (personal development)*, and .68 for *Factor 4 (self-enhancement)*. The CR values for the Israeli sample are as follows: .60 for *Factor 1*, .63 for *Factor 2*, .73 for *Factor 3* and .62 for *Factor 4*. Therefore, for all the factors, the recommended threshold of ≥.60 (Bagozzi and Yi 1998) was achieved.

In addition, we calculated factor determinacy, which is a measure of the quality of factor scores and which is expressed as a correlation between the estimated factor score and the factor itself. The factor determinacy scores were above the desired threshold of .80 (Muthén and Muthén 2012). For the US sample, factor determinacy scores were as follows: .85 for

Factor 1 (career & community), .86 for *Factor 2 (interpersonal relationships)* and for *Factor 3 (personal development)*, and .87 for *Factor 4 (self-enhancement)*. For the Israeli sample, factor determinacy scores were as follows: .91 for *Factor 1*, .89 for *Factor 2*, .90 for *Factor 3*, and .87 for *Factor 4*.

Discriminant and Convergent Validity

Discriminant validity was tested using the inter-correlations between LDR-P factors, while convergent validity was tested using the correlations between LDR-P factors and behavioral procrastination (AIP) and decisional procrastination (DP). These correlations are presented in Table 6. Discriminant validity requires that the dimensions of a construct reflect distinct components and, thus, should not be associated too strongly. Although there is no standard rule, a correlation less than .85 indicates that discriminant validity likely exists between the scales (Lee et al. 2014; Spreitzer 1995). Convergent validity requires indicator loadings to be .6 or more (Bagozzi and Yi 1998).

Results showed that for the US sample, the inter-correlations between LDR-P factors ranged from .56 to .67, while for the Israeli sample, they were between .71 and .89. Correlations between LDR-P factors, AIP, and DP in the US sample ranged between .37 and .73, while in the Israeli sample, they ranged between .06 and .26. Based on the guidelines for discriminant and convergent validity as stated above, we can conclude that the results are in favor for discriminant validity and partially for convergent validity in the US sample, but they raise some questions about these types of validity of the measures in the Israeli sample.

The existence of metric and partial scalar invariances allowed us to compare statistically correlations between the LDR-P factors themselves, LDR-P factors and two other types of procrastination and latent means of LDR-P factors between the two samples. This was done by comparison of models where correlation coefficients or latent means were constrained to be equal between the two samples to the unconstrained model where all the coefficients or latent means

Table 5 Measurement invariance tests and fit indices of the assessed models

Model (type of invariance)	χ^2	df	χ^2/df	p	RMSEA (90% CI)	Pclose	CFI	TLI	AIC	BIC	SRMR
Configural	269.96	96	2.81	<.001	0.05 (0.04; 0.06)	0.63	0.93	0.91	52,285.79	52,734.26	0.05
Full metric	286.23	104	2.75	<.001	0.05 (0.04; 0.06)	0.71	0.93	0.91	52,288.08	52,693.83	0.05
Full scalar	487.92	112	4.36	<.001	0.07 (0.06; 0.07)	0.00	0.85	0.83	52,519.31	52,882.35	0.07
Partial scalar (1,2,4,9 free)	295.87	108	2.74	<.001	0.05 (0.04; 0.06)	0.73	0.93	0.91	52,289.54	52,673.94	0.05
Model comparison	$\Delta \chi^2$	Δdf	p	ΔCFI							
Full metric vs. Configural	12.29	8	0.14	0.03							
Full scalar vs. Full metric	201.68	8	<.001	0.04							
Partial scalar vs. Full metric	7.26	4	0.12	0.04							

Table 6 Pearson correlations between LDR-P factors and other variables

		Israel					
		1	2	3	4	5	6
1	Factor 1: Career & community	–	.89***	.74***	.91***	.26***	.22**
4	Factor 2: Interpersonal relationships	.67***	–	.76***	.71***	.19**	.18**
3	Factor 3: Personal development	.65***	.67***	–	.62***	.17**	.13*
4	Factor 4: Self-enhancement	.66***	.56***	.67***	–	.06	.24***
5	AIP	.73***	0.42***	.43***	.37***	–	.45***
6	DP	.73***	0.48***	.44***	.45***	.63***	–

* $p < .05$; ** $p < .01$; *** $p < .001$

were estimated freely. Since these models are nested within each other, we used a Chi-square difference test to evaluate the model fit of the constrained versus unconstrained model (Fan and Sivo 2009) with Sattora-Bentler correction, because we estimated our models with robust maximum likelihood (RML) estimation (Sattora and Bentler 1994). Comparisons of correlations revealed that all the inter-correlations between the LDR-P factors were significantly stronger for the Israeli sample (except the correlation between *Factor 3* and *Factor 4*), while all the correlations between the LDR-P factors and two other types of procrastination were significantly stronger for the US sample (see Table 7). Comparisons of latent means

showed that the latent means of *Factor 1* was significantly higher for the US sample (difference of .54 points).

Discussion

Life regrets over inactions was found to have a long-term negative effect on people’s lives (Beike et al. 2009; Morrison et al. 2012; Morrison and Roesse 2011). Procrastination can be considered a prevalent unique type of inaction, characterized by the presence of discomfort. However life regrets in relation to procrastination was only

Table 7 Correlations between factors and latent means comparisons between the US and Israeli samples

Model	Difference between correlation coefficients (IL-US)	Model comparison using Sattora-Bentler Scaled χ^2
1	Unconstrained	$\chi^2 = 286.23, df = 104$
2	F1 <->F2 equal	.22 $\chi^2 = 297.16, df = 105$ $\Delta\chi^2 = 10.93, \Delta df = 1, p < .001$
3	F1 <->F3 equal	.09 $\chi^2 = 289.36, df = 105$ $\Delta\chi^2 = 3.13, \Delta df = 1, p < .01$
4	F1 <->F4 equal	.25 $\chi^2 = 299.37, df = 105$ $\Delta\chi^2 = 13.14, \Delta df = 1, p < .001$
5	F2 <->F3 equal	.09 $\chi^2 = 289.36, df = 105$ $\Delta\chi^2 = 3.13, \Delta df = 1, p < .01$
6	F2 <->F4 equal	.15 $\chi^2 = 290.78, df = 105$ $\Delta\chi^2 = 4.55, \Delta df = 1, p < .001$
7	F3 <->F4 equal	-.05 $\chi^2 = 287.76, df = 105$ $\Delta\chi^2 = 1.53, \Delta df = 1, p = .13$
8	F1 <->AIP equal	-.47 $\chi^2 = 298.08, df = 105$ $\Delta\chi^2 = 11.85, \Delta df = 1, p < .001$
9	F2 <->AIP equal	-.24 $\chi^2 = 290.80, df = 105$ $\Delta\chi^2 = 4.57, \Delta df = 1, p < .001$
10	F3 <->AIP equal	-.26 $\chi^2 = 291.38, df = 105$ $\Delta\chi^2 = 5.15, \Delta df = 1, p < .001$
11	F4 <->AIP equal	-.31 $\chi^2 = 292.10, df = 105$ $\Delta\chi^2 = 5.87, \Delta df = 1, p < .001$
12	F1 <->DP equal	-.51 $\chi^2 = 298.90, df = 105$ $\Delta\chi^2 = 12.67, \Delta df = 1, p < .001$
13	F2 <->DP equal	-.30 $\chi^2 = 292.33, df = 105$ $\Delta\chi^2 = 6.10, \Delta df = 1, p < .001$
14	F3 <->DP equal	-.31 $\chi^2 = 292.34, df = 105$ $\Delta\chi^2 = 6.11, \Delta df = 1, p < .001$
15	F4 <->DP equal	-.21 $\chi^2 = 297.15, df = 105$ $\Delta\chi^2 = 10.92, \Delta df = 1, p < .001$
Difference between latent means (IL-US)		
1	Unconstrained	$\chi^2 = 295.86, df = 108$
2	F1 equal	-.54 $\chi^2 = 350.56, df = 109$ $\Delta\chi^2 = 54.7, \Delta df = 1, p < .001$
3	F2 equal	-.02 $\chi^2 = 296.47, df = 109$ $\Delta\chi^2 = 0.61, \Delta df = 1, p = .44$
4	F3 equal	-.06 $\chi^2 = 297.07, df = 109$ $\Delta\chi^2 = 1.21, \Delta df = 1, p = .27$
5	F4 equal	-.03 $\chi^2 = 296.64, df = 109$ $\Delta\chi^2 = 0.78, \Delta df = 1, p = .38$

briefly studied (Ferrari et al. 2009; Kuhnle et al. 2011; Pittman et al. 2008). Following the above literature and the absence of a scale that specifically measures life-domain regrets regarding procrastination, the main aim of this study was to adjust the LDR scale (Roese and Summerville 2005) to measure LDR regarding procrastination (LDR-P). In addition, we validated this measure using a cross-cultural sample, in order to allow the cross-cultural generalizability of findings, usage of scales, and the overall detection of cross-cultural differences in regret regarding procrastination (Boer and Fischer 2013; McCabe et al. 2008). Finally, we examined the relationships between the LDR-P scale factors and two other procrastination scales.

Our descriptive findings indicated that LDR-P scale revealed the highest means in *health*, *career*, *community* and *education* life-domains and the lowest means in *parenting* and *spirituality* life-domains. When compared to other mean scores in the life-domain regret literature (Beike et al. 2009; Morrison and Roese 2011), similarities were found in some of the most regretted life-domains (*health*, *education* and *career*). However, several other life-domains differed. *Finance*, *self*, *romance* and *family* life-domains were highly regretted in the reviewed studies but were not in our study. Further, in our sample, *parenting* and *spirituality* life-domains were the least regretted, while in the reviewed studies, *leisure*, *friends* and *self* life-domains were the least regretted. These results may suggest that life-domain regret regarding procrastination is similar to life-domain regret regarding other inactions (Gilovich et al. 2003), but only to some degree. This may suggest that procrastination is a type of inaction, but it is mostly a delay of the action and therefore is regretted in a somewhat different manner. A comparison of our results to the literature on life-domain procrastination (Klingsieck 2013) reveals that people regret procrastination the most in those life-domains where they tended to procrastinate the most – *academics* and *work*. Our results also partially aligned with the results of Ferrari et al. (2009) who examined life-domain regret in chronic procrastinators. In both studies, procrastination was most regretted in *health* and *education* life-domains and the least in *spirituality*.

The results of the exploratory factor analysis revealed that LDR-P is a multi-dimensional construct characterized by four factors: *Factor 1 (career and community)* - *career*, *education*, *community*, and *finance*, *Factor 2 (interpersonal relationships)* - *family*, *parenting*, and *friends*, *Factor 3 (personal development)* - *leisure*, *health*, and *romance*, and *Factor 4 (spirituality and self (self-enhancement))*.

Based on previous literature, we expected that the factorial structure of LDR-P would reflect both the life-domain regret and the life-domain procrastination patterns mentioned in the literature. We examined the missed opportunity principle (Beike et al. 2009), and the inaction effect (Morrison and Roese 2011) from the literature on regret and the life-domain

procrastination presence effect from the literature on procrastination (Ferrari et al. 2009; Klingsieck 2013). The results of the factor analysis indicated that the procrastination presence effect could better explain our factorial structure as described by Klingsieck (2013), suggesting *Factor 1 (career & community)* as grouping the life-domains where people procrastinate more often, and *Factor 2 (interpersonal relationships)* as where people procrastinate less often. *Factors 3 (personal development)* and *4 (self-enhancement)* involve those domains where people mildly procrastinate (Klingsieck 2013). Our findings can also be explained by Ferrari et al. (2009) findings regarding regret in avoidant procrastinators. In their study, avoidant procrastinators mostly regretted *education*, *community*, *romance* and *career* (similar to *Factor 1* in our study), and they least regretted *family*, *parenting*, *friends* and *self* (similar to *Factor 2* in our study).

Further, to validate the factorial structure of LDR-P, we performed a confirmatory factor analysis in both the US and Israeli samples and found that the four-factor structure held in both cultures (configural invariance). We also found that people from both cultures understood the LDR-P items in the same manner, meaning that regression models and correlations of its factors can be compared between these two cultures (metric invariance). Finally, we found that people partially rated the LDR-P items in the same manner, meaning that latent means of those items can be meaningfully compared between the two cultures (partial scalar invariance).

Comparisons of correlations between the two cultural groups revealed some minor differences. We found that most of the inter-correlations between the LDR-P factors were significantly stronger for the Israeli sample, suggesting that Israelis report more similarly regret regarding procrastination across all life-domains in comparison to Americans. Further, the correlations between the LDR-P factors and the two other types of procrastination (general and decisional) were significantly stronger for the US sample, suggesting that the general tendencies to procrastinate are associated to regret regarding procrastination in all life-domains stronger in the US sample. In addition, the comparisons of latent means showed that the latent mean of *Factor 1 (career & community)* was significantly higher for the US sample. These initial findings should be interpreted with caution, but it may suggest that life-domain regret regarding procrastination, similar to other human cognitive-emotional states, is influenced by cultural norms and can be detected by the LDR-P scale. Other studies that examined cross-cultural differences between these two cultures assumed Israel as an collective-oriented culture that is often characterized by low uncertainty avoidance, low future orientation and strong intergroup relations, whereas the US as an individualistic culture where independence, freedom of choice, and pursuing individual goals are highly valued. These studies revealed some differences in social attitudes, work values and behavior (Baum et al. 1993; Berkowitz

et al. 2004; Elizur et al. 1991; Hojat et al. 2003; Leyser et al. 1994), between the two cultures, however no study that compared feelings such as regret was found. Gilovich et al. (2003) that compared regret over actions and inactions across individualistic versus collective cultures did not find cultural differences. On the other hand, Chen et al. (2006) found that American in comparison to Chinese students had a greater tendency to generate additive counterfactuals (inactions) in the domains of schoolwork and family. They speculated that this difference might reflect cultural differences in goal regulation and self-improvement. Following these studies, our findings may add to the notion that cross-cultural difference is not imbedded in the overall mechanism of counterfactual thoughts but rather can be detected in examining specific life-domains. However, in order to better understand the actual cultural meanings of these findings, further studies are needed.

Strengths, Limitations and Future Research

This study should be weighed in consideration of its strengths and shortcomings that might suggest future lines of research. First, it is the first study to provide an in-depth investigation on the construct validity of the life-domain regret regarding the concept of procrastination. Second, it is based on relatively large samples, which provided the analyses with a good power and allowed us to test the measurement invariance of the LDR-P. Third, it shows promising results and provides initial implications for a cross-cultural comparability of the LDR-P construct. Fourth, unlike the majority of procrastination studies, our samples consisted of adult, non-student participants, allowing for a wider range of life and regret experiences (Morrison and Roese 2011).

Despite the strengths, a few limitations should be noted and could be addressed in future studies. First, we employed a closed questionnaire that asked people to refer only to twelve life-domains, while other studies in the life-domain regret literature usually collect data by asking people to describe their regrets (Dijkstra and Barelds 2008; Wrosch and Heckhausen 2002). Second, the data were self-reported and, as such, are prone to various known biases (e.g., social desirability, memory recall biases). However, in the case of procrastination research, the study by Krause and Freund (2014) showed that self-reported measures of procrastination were even more reliable than behavioral ones. Third, the data were collected online and it is arguable that the use of traditional paper-and-pencil methods of data collection may have led to a different set of results. However, previous research has demonstrated that online responses are generally as valid and reliable as those that are collected offline (Hiskey and Troop 2002). Fourth, the LDR-P measure has been validated using samples from two Western cultures, and we still know nothing about its applicability for other cultures (e.g., Eastern). Finally, the clear majority of our sample was Caucasian (for the US sample) or

Jewish (for the Israeli sample), which might constrain the generalizability of our results to other ethnic groups.

Considering these limitations, future research on life-domain regret as it regards procrastination should explore this concept using closed and open-ended questionnaires and should be replicated within different contexts and cultures. A follow-up study might continue examining further psychometric characteristics of the LDR-P, including convergent and discriminant validity by using additional measures of procrastination and other psychological variables. Finally, it is also advisable that future studies using other designs (e.g., longitudinal) with more representative samples (e.g., probability samples) should be conducted.

Conclusions

This initial study suggests that LDR-P is a multidimensional, valid construct that can be measured within groups and can be compared cross-culturally. To strengthen and better understand the factorial structure we found, this construct needs to be further explored, and examined in relation to other constructs. A better understanding of this human experience can benefit both the life-domain regret literature and, more important, the literature regarding procrastination in different life-domains, which is very limited. This understanding can contribute to addressing and preventing procrastination and the regret over procrastination in different life-domains. The validation of our factorial structure in two very different cultures widens our ability to measure and examine this construct across different cultural groups and to make comparisons between them.

Compliance with Ethical Standards

Conflict of Interest All authors declare that they have no conflict of interest in pursuing this publication.

Ethical Approval This article does not contain any studies with animals performed by any of the authors. Informed consent was obtained from all individual participants included in the study. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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