This is a repository copy of *Development and validation of the General Procrastination Scale (GPS-9): A short and reliable measure of trait procrastination*.

White Rose Research Online URL for this paper:
http://eprints.whiterose.ac.uk/147779/

Version: Accepted Version

Article:
Sirois, F.M. orcid.org/0000-0002-0927-277X, Yang, S. and van Eerde, W. (2019) Development and validation of the General Procrastination Scale (GPS-9): A short and reliable measure of trait procrastination. Personality and Individual Differences, 146. pp. 26-33. ISSN 0191-8869

https://doi.org/10.1016/j.paid.2019.03.039

Article available under the terms of the CC-BY-NC-ND licence (https://creativecommons.org/licenses/by-nc-nd/4.0/).

Reuse
This article is distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs (CC BY-NC-ND) licence. This licence only allows you to download this work and share it with others as long as you credit the authors, but you can't change the article in any way or use it commercially. More information and the full terms of the licence here: https://creativecommons.org/licenses/

Takedown
If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.

eprints@whiterose.ac.uk
https://eprints.whiterose.ac.uk/

RUNNING HEAD: GPS-9 development and validation

Please cite as:

Sirois, F. M., Yang, S., & van Eerde,W. (in press). Development and validation of the GPS-9, a short and reliable measure of trait procrastination. *Personality & Individual Differences*.

Development and validation of the GPS-9, a short and reliable measure of trait procrastination

Fuschia M. Sirois, PhD[1]

Sisi Yang, MSc[1]

Wendelien van Eerde, PhD[2]

[1]Department of Psychology, University of Sheffield, United Kingdom

[2]Business School, University of Amsterdam, the Netherlands

Correspondence concerning this article should be addressed to Fuschia M. Sirois, PhD, Department of Psychology, University of Sheffield, Cathedral Court, 1 Vicar Lane, Sheffield, S1 2LT, UK; tel: +44 (0) 114 222 6552; Email: f.sirois@sheffield.ac.uk

Abstract

Trait procrastination is increasingly recognised as having relevance for a number of consequential outcomes, including health. However, research with clinical populations may be hindered by longer scales. The present research addresses this issue by developing and validating a short version of Lay's General Procrastination Scale (GPS), a widely used self-report measure of trait procrastination. Study 1 used factor analysis to reduce the 20-item GPS to 9 items across two large samples *(N* = 620, *N* = 920). In Study 2 the GPS-9 demonstrated very good internal consistency across 15 student, adult and chronic illness samples, with a meta-analysis of coefficient alpha finding an average reliability coefficient of .89 (Total *N* = 4,492). The GPS-9 also demonstrated good test-retest reliability (*r* = .89), and the expected associations with variables known to be part of the nomological network of trait procrastination. Findings from the current research provide evidence that the GPS-9 is a brief, valid, and reliable measure of trait procrastination.

Keywords: procrastination; measurement; stress; affect; validation; psychometrics

Introduction

As one of the most common and ubiquitous forms of self-regulation failure (Ferrari, Díaz-Morales, O'Callaghan, Díaz, & Argumedo, 2007; Steel, 2007), procrastination is increasingly recognised as having relevance for a number of consequential outcomes, including academic performance (Hen & Goroshit, 2014), work life (Gupta, Hershey, & Gaur, 2012), well-being (Stead, Shanahan, & Neufeld, 2010), and physical health (Sirois, 2015; Sirois, Melia-Gordon, & Pychyl, 2003). This is especially true when procrastination is assessed as a relatively stable, trait-like chronic tendency to voluntarily and unnecessarily delay intended and important tasks as a way of regulating immediate mood despite the negative consequences of this delay for the future self (Sirois & Pychyl, 2013). The burgeoning interest in trait procrastination and its consequences is illustrated by the increase in citations to Lay's General Procrastination scale (GPS; Lay, 1986), the most widely used and validated measure of trait procrastination. According to Google Scholar, the paper introducing the GPS has been cited 955 times to date, and the majority (572) of these citations have occurred in the past five years.

The rise of interest and awareness of the consequences of procrastination has meant that researchers have started to investigate trait procrastination in populations other than undergraduate students, as well as investigate a wider scope of the possible implications of procrastination. For example, several studies have examined trait procrastination in healthy adult populations (Hen & Goroshit, 2018; Sirois, 2007; Svartdal, Granmo, & Færevaag, 2018). However, research focused on the relevance of trait procrastination for clinical populations is scant (Sirois, 2016), despite the evidence that poor mental health and higher stress are a consequence of chronic procrastination (Flett, Stainton, Hewitt, Sherry, & Lay, 2012; Sirois et al., 2003; Stead et al., 2010), and that such outcomes may be particularly detrimental to those living with medical or other clinical conditions (Dimsdale, 2008; Evers et al., 2013). In such populations, participant burden is a key concern when conducting

research, making short measures more desirable than their longer counterparts when the overall assessments include multiple measures. Indeed, Stanton and colleagues have noted that longer surveys come with several costs, including taking more time to complete, often yielding more missing data, and having higher refusal rates than shorter surveys (Stanton, Sinar, Balzer, & Smith, 2006). Accordingly, there is a need for a short and reliable measure of trait procrastination to facilitate research with clinical populations and increase understanding of the relevance of trait procrastination for consequential outcomes.

Lay's General Procrastination Scale (GPS; Lay, 1986) is arguably the most widely used of all currently available measures of trait procrastination. Construction of the GPS was guided by the recommendations of Jackson (1970), with the final items comprising the GPS being derived from a factor analysis of an initial pool of 18 true and 18 false items. Consisting of 20 items, 10 of which are reverse scored, the GPS is a unidimensional scale that was originally validated across three studies, one of which was with a community adult sample. Criterion related validity included a measure of behavioural delay – returning a letter by post without delay. Subsequent research using the GPS has noted good incremental validity in predicting outcomes over and above the big five personality factors (Lay, 1997; Sirois, 2015; Sirois, Stride, & Pychyl, forthcoming), and excellent test-retest stability over a ten year period (Steel, 2007). Behaviour genetics research with 386 same-sex twin pairs using the GPS has also revealed an estimated 46% heritability at the phenotypic level, supporting the relative stability of trait procrastination when measured with the GPS (Gustavson, Miyake, Hewitt, & Friedman, 2014).

The current research

The current research sought to create and validate a short version of the GPS to help facilitate research in situations where the use of the full 20-item version may create undo participant burden for researchers seeking to understand the correlates and consequences of

trait procrastination. We used a multi-stage approach to construct and validate the new shortened version of the GPS. In Study 1, we followed the recommendations of Widaman et al. (2011) for optimal creation of short form of a scale from existing data, and selected items with the highest loadings on the common factor using factor analytic techniques, which is one of the three recommended empirical approaches for selecting items. Because this approach can be problematic and produce biased results when using a single data set (Widaman et al., 2011), we replicated the analysis with a second data set to confirm the item loadings.

In Study 2 we sought to provide preliminary evidence of the psychometric properties of the new shortened scale, including its relationship to higher order personality traits and consequential outcomes known to be associated with the full version of the GPS. We examined the properties of the new scale in 15 independent samples, and then statistically meta-analysed the coefficient alpha to obtain an estimate of the average internal reliability of the new scale, as well as testing potential moderators of the scale's reliability. We also examined correlations of the new shortened scale with measures of conscientiousness and neuroticism, two personality factors known to be associated with trait procrastination (Van Eerde, 2003). It was expected that, consistent with previous research, the new shortened GPS would correlate positively with neuroticism and negatively with conscientiousness. Because research has demonstrated consistent relationships between the GPS and lower levels of positive affect (Balkis & Duru, 2015; Sirois & Giguère, 2018), and higher levels of negative affect and stress (Flett, Haghbin, & Pychyl, 2016; Sirois, 2014b), we also examined how the new shortened scale was associated with these variables. For each set of correlations, we then estimated the average associations with each by statistically meta-analysing the effects.

Study 1 – Scale Construction

The purpose of Study 1 was to construct the new shortened version of the General Procrastination Scale by selecting items with highest loading from the original 20-item scale from an existing data set.

Participants and procedure

Study 1 involved a secondary analysis of data from two large samples used to select the top loading items from the GPS to be used in the new short version of the scale. After first obtaining ethical approval from the University Research Ethics Board, both samples were recruited from the Internet with online advertisements posted to online survey sites. Sample 1 included 636 adults who completed an online survey focused on goals and the future self. Data from 16 participants who had missing data on one or more of the items on the GPS were removed, leaving a final analytic sample of 620 (mean age = 27.73, SD = 11.47, 78% female). The majority of participants had a college/university education (69% percent), with 18% having a postgraduate education, and 14% having a high school education. Sample 2 consisted of 980 adults, of which only 920 provided complete data for the GPS. The final analytic sample was predominantly male (63%), and slightly older than Sample 1 (mean age = 32.62, SD = 9.91), but with a similar educational profile: 63% percent college/university education, 25% postgraduate education, and 11% high school education.

Participants in Sample 1 participated for a chance to win a voucher to an online retailer. In Sample 2, the first 500 participants were paid an incentive of $15 Canadian, and the remaining participants were offered the opportunity to enter a draw to win gift certificates of varying values.

Measures

In addition to demographics questions, both samples completed the General Procrastination scale (Lay, 1986).

General procrastination. Lay's General procrastination scale (GPS; Lay, 1986), is a

20-item scale that assesses global, trait-like tendencies towards procrastination across a variety of tasks (e.g., “In preparing for some deadlines, I often waste time by doing other things.”) Participants rated their agreement with each item on a 5-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). After reverse scoring 10 items, all items are averaged into a single score with higher values indicating a greater tendency towards chronic procrastination. The GPS has demonstrated good internal consistency previously (alpha = 0.82; Lay, 1986), and has excellent 10 year test-retest reliability (Steel, 2007). The internal consistency in both samples in the current study were very good (alpha = .91).

Analysis

Principal components analysis (PCA) was used to extract the items to comprise the short version of the General Procrastination scale. This approach was taken rather than a true exploratory factor analysis as the aim was to verify high loading items for retention rather than to explore any underlying factor structure of the items (Kline, 1994). The PCA was run first on Sample 1, and then on the larger Sample 2. Items with the highest loadings in both samples were considered candidates for retention in the new scale. Given the original scale has 20 items and the aim was to create a considerably shorter scale, that is one that had 50 percent or fewer items, a provisional lower threshold of .60 was set for item retention. However, only items that loaded at .60 or higher in both samples would be retained. This decision was guided by Field (2005) who advocates the suggestion of Guadagnoli & Velicer (1988) that a factor can be considered to be reliable if four or more loadings are at least 0.6, regardless of sample size.

The General Procrastination Scale (Lay, 1986) assesses chronic procrastination as a unidimensional construct. Accordingly, the component matrix was not rotated as the aim was not to extract factors but to evaluate the item loadings on the expected main component. To verify the proposed unidimensionality of the GPS, a scree plot was generated, and visually

evaluated following Catell's (1978) guidelines. Coefficient alpha was also generated for the items extracted for the new scale to assess its internal consistency.

Results and Discussion

Table 1 presents the factor loadings of the 20 items of the General Procrastination scale. In Sample 1, the scree plot confirmed the unidimensionality of the scale, with the "elbow" appearing after the first factor. There were 9 items with loadings above .60, with 3 of these items being reverse scored items. The results of the PCA for Sample 2 were generally consistent with those of Sample 1. The highest loading items from Sample 1 were also the highest loading items in Sample 2. However, there were two additional items in Sample 2 that had loadings above .60. Both of these items had loadings below .60 in Sample 1. This suggested that they should not be included in the new scale. The internal consistency of the new 9 item scale was next calculated after reverse scoring the two negatively worded items that were retained. In both samples the internal consistency of the new 9-item short General Procrastination Scale, or GPS-9, was very good (alpha = .90). This alpha coefficient is similar to what is generally found with the full 20 item version of the GPS.

However, as John and Soto (2007) have noted, reliability does not ensure construct validity. Despite the fact that the items in the short version were taken from the original 20-item GPS, it could be argued that the items selected do not adequately represent the trait procrastination construct as originally envisioned and validated by Lay (1986). It is crucial therefore that the new scale be tested in relation to other traits and correlates known to be part of the nomological network of trait procrastination.

Study 2 – Validation of the GPS-9

Having selected the 9 items to comprise the new shortened version of the GPS in Study 1, in Study 2 we sought to provide validation of the new GPS-9 by examining how it

related to known correlates of the full scale, and by estimating its psychometric properties across a number of samples.

Participants and Procedure

Data from fifteen independent samples was collected following obtaining ethical approval from the University Research Ethics Boards of Universities in Canada and the United Kingdom (UK). Samples were recruited using a variety of similar means including adverts posted on University volunteers lists, and notices posted via social media and on online psychology research websites. Sample 8, an all student sample, was recruited using the university participation credit portal at the UK university.

All samples with the exception of Sample 8, completed the survey online; Sample 8 completed a paper survey in the Lab. Sample 15 completed a survey at two time points, 2 weeks apart. However, only 195 of the original 348 participants completed the Time 2 survey. All samples provided consent before participating. Recruitment for the two chronic illness samples (Sample 1: fibromyalgia, Sample 2: chronic fatigue syndrome) additionally utilised a notice placed in the UK Fibromyalgia newsletter, and on relevant online support boards. The remaining samples consisted of a mixture of community adults and university undergraduate and postgraduate students. The demographic characteristics of the 15 samples (total $N = 4{,}492$) are provided in Table 2. In summary, the mean age of the samples ranged from 24.55 to 41.99, and the majority of participants in each sample were White (75% to 100%) and female (60% to 100%).

Measures

In addition to demographic characteristics (age, gender, education level, ethnicity) participants completed the new GPS-9 along with a set of measures that included the following measures that were analysed for the current study. Table 3 presents the means and Cronbach alphas for all scales used in the validity analyses in each sample.

Big Five personality factors. Two samples (Samples 1 and 2) completed a 10-item measure of the Big Five inventory (Rammstedt & John, 2007) to assess two of the five Big Five personality factors of interest for this study: conscientiousness and neuroticism. Characteristics reflecting each factor are presented after the statement "I see myself as someone who …" Characteristics are rated on a 5- point Likert scale ranging from 1 (Disagree strongly) to 5 (Agree strongly) with higher scores reflecting greater identification with the personality factor. The conscientiousness and neuroticism subscales have demonstrated good convergent and discriminant validity in previous research (Rammstedt & John, 2007).

Perceived stress. The 10-item Perceived Stress Scale (PSS; Cohen & Williamson, 1988) was completed by Samples 1, 2, 5, 9, 10, 13, and 15 to assess the perceived stressfulness of events experienced within the past month. The PSS is the most widely used empirically established index of general perceived stress. Items such as "In the last month, how often have you felt nervous and stressed?" are rated on a 5-point scale. Response options range from "never" to very "often" and items are averaged after reverse scoring 4 items to obtain a total score that reflects higher levels of subjective stress. The PSS has demonstrated good convergent and predictive validity with depression, life events, depression, health behaviors, and use of health services (Cohen, Kamarck, & Mermelstein, 1983; Cohen & Williamson, 1988; Hewitt, Flett, & Mosher, 1992), and has shown adequate internal consistency in previous research (Cohen & Williamson, 1988).

Positive and negative affect. Eight of the fifteen samples (Samples 3-6, 9, 10, 13, 15) completed one of two measures of positive and negative affect. Six samples completed the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS consists of 20 mood adjectives, 10 items each for state positive and state negative affect, rated on a 5-point Likert scale ranging from 1 for (*very slightly or not at all)* to 5 for

(*extremely).* Sample 4 completed a 10 item abbreviated version of the PANAS presented as a visual analogue scale with responses ranging from 1 (*very slightly or not at all)* to 100 for (*extremely).* Samples 6 and 7 completed a visual analogue, 10-item version of the PANAS via a paper survey in which they indicated how much they were currently experiencing each emotion by clicking a slider in the online survey. Psychometric properties for the PANAS subscales include good discriminate and internal reliability (alpha = .88)(Crawford & Henry, 2004).

Analysis Strategy

Descriptive statistics (means and standard deviations) were calculated for each of the 15 samples to assess whether the mean scores were within range of those obtained from the original 20 item measure. Bivariate correlations for the GPS-9 with conscientiousness and neuroticism were calculated to assess convergent validity, and correlations with perceived stress, and positive and negative affect were calculated to assess the criterion related validity of the GPS-9. Each of these two forms of validity are key for establishing the construct validity of a personality scale (John & Benet-Martinez, 2000). To estimate the average association of the GPS-9 with each of the validity variables, we used a random effects model meta-analysis conducted with Comprehensive Meta-Analysis (CMA), Version 2 software (Borenstein, Hedges, Higgins, & Rothstein, 2005). CMA first transforms the individual correlation coefficients into Fisher's *z* scores before meta-analyzing the effects. The variability in the coefficient alphas between samples was evaluated with two approaches to determine whether a subgroup moderator analyses was warranted to probe the source of any potential variability, such as age or gender. We used the heterogeneity statistic, *Q*, to assess the degree of variability among the pool of effect sizes, i.e., correlations (Card, 2012). Moderator analysis is warranted if this statistic is associated with a large confidence interval. We also used the I^2 statistic to estimate the proportion of variability present that is not due to

sampling error within studies (Higgins & Thompson, 2002). The guidelines for assessing variability are that I^2 values of 25 percent reflect low heterogeneity, 50 percent reflect moderate heterogeneity, and 75 percent or more reflect high heterogeneity (Card, 2012). Because there were only two samples with measures of conscientiousness and neuroticism, the correlations with these variables were not meta-analysed. Two-week test-retest reliability was calculated for sample 15 using Pearson's *r*.

To assess the internal consistency of the new GPS-9 we calculated coefficient alphas for each of the 15 samples. To estimate the reliability generalisation of the GPS-9, the average internal consistency of the GPS-9 was calculated by meta-analysing the coefficient alphas across the 15 samples using CMA. We used the approach and formula suggested by Rodriguez and Maeda (2006) which involves first transforming coefficient alpha (*T*-alpha) and its confidence intervals. The *T*-alphas are then meta-analysed using a random effects model, and the values for the resulting alpha and 95 percent confidence intervals are then transformed back to an alpha metric for ease of interpretation. The variability in the coefficient alphas between samples was evaluated with the *Q* and the I^2 statistic to determine whether subgroup moderator analyses was warranted to probe the source of any potential variability in the internal consistencies across samples.

Results and Discussion

Descriptive statistics. The means scores for the GPS-9 were generally similar to those obtained with the full GPS across the different sample types, albeit slightly higher (See Table 5). The means for the community samples ranged from 2.92 to 3.42, which is slightly higher but with the same range as those obtained from other studies with community dwelling adults, 2.62 to 3.23 (Ferrari, O'Callaghan, & Newbegin, 2005; LaVoie & Pychyl, 2001; Sirois, 2007). The means for the two student samples were 3.05 and 3.16, were also slightly higher than those obtained in other studies with undergraduate students, 2.68 to 2.94 (Blunt &

Pychyl, 1998; Sirois, 2014b). Lastly, the means for the two chronic illness samples, 3.24 and 3.30, were also slightly higher than those found in a study of people with hypertension and cardiovascular disease, 2.82, the only other published research using the full GPS with a chronic illness sample (Sirois, 2015). However, the two chronic illness samples in in the current research were people with chronic fatigue syndrome and fibromyalgia, two conditions that are characterised by high levels of fatigue and pain (Meeus & Nijs, 2007; Nicassio, Moxham, Schuman, & Gevirtz, 2002), which can interfere with daily functioning and self-regulation (Solberg Nes, Roach, & Segerstrom, 2009).

Validity correlations. The correlation analysis revealed that the GPS-9 was significantly associated with each of the validity variables in the expected direction, with the expectation of the correlation with negative affect in Sample 5 not reaching significance (Table 4). Consistent with a previous meta-analysis (Van Eerde, 2003), trait procrastination as measured by the GPS-9 was negatively associated with conscientiousness, and positively associated with neuroticism. Scores on the GPS-9 were also negatively associated with positive affect, and positively associated with negative affect, findings that are in agreement with previous research (Flett et al., 2016; Sirois & Giguère, 2018). Lastly, the GPS-9 showed the expected positive association with perceived stress, as the full length GPS has demonstrated robust positive relationships with perceived stress as measured by the PSS (Sirois, 2014b, 2015; Sirois & Kitner, 2015; Sirois et al., 2003).

The meta-analyses of the associations of the GPS-9 with affect revealed an overall average correlation of -.285 (k = 8; 95% C: -.32, -.25) for positive affect, and average correlation of .313 (k = 8; 95% C: .27, .35) for negative affect. The average correlation of the GPS-9 with perceived stress was .398 (k = 7; 95% C: .34, .45). Test of the heterogeneity of these effects suggested that the effects did not vary systematically across the samples tested for either positive affect (Q (7) = 7.09, p = .420; I^2= 1.21 %), or negative affect (Q (7) = 9.12,

p = .240; I^2= 23.7 %). The heterogeneity test for perceived stress was marginally significant, and the I^2 indicated a moderate degree of heterogeneity (Q (6) = 12.51, p = .052; I^2= 52.02 %). However, given the marginal significance, it was decided that no further tests of potential moderators were warranted.

Overall, these results support the criterion-related and convergent validity of the GPS-9. The current findings indicate that the GPS-9 demonstrates associations of the same direction and magnitude with the big five traits as does the full 20 item GPS. A meta-analysis of the full GPS found an average correlation of -.63 with conscientiousness, and .26 with neuroticism (Van Eerde, 2003). In the current study, the GPS-9 had correlations with conscientiousness of -.42 and -.43, and with neuroticism of .20 and .35. The correlations with neuroticism are within target range of those found in the meta-analysis, and thus can be considered comparable. Although the correlations with conscientiousness found in the current study are smaller than those found previously for the full GPS, they can be considered within the same magnitude range, that is, a moderate size correlation (Cohen, 1988). That they were obtained with chronic illness samples rather than a non-medical sample may explain the smaller correlations.

With respect to positive and negative affect, the associations of the GPS-9 with positive affect found in the current study are similar to those found in other research, which noted correlations of -.27 to -.37 (Lay, 1992; Sirois, 2014a). The magnitude of associations with negative affect were also within the same range as those found in other research, for example, correlations of .24 to .32 (Lay, 1992; Martin, Flett, Hewitt, Krames, & Szanto, 1996). The GPS-9 also performed similarly to the full GPS in its associations with stress as measured by the PSS. Previous research has noted correlations of the full GPS and stress ranging from .20 to .36 (Sirois, 2014a, 2014b). The correlations found in the current analyses were towards the upper end of this range, although similar in magnitude overall.

Test-retest reliability. The test-retest reliability of the GP-9 was assessed in sample 15 over a two-week period. The results revealed very good stability with a correlation of .89 between the two time points. Previous research has noted that the full GPS has a test-retest reliability of .80 over a one-month period (Ferrari, 1989).

Test of reliability generalization. Across all 15 samples the new GPS-9 demonstrated very good internal consistency, with coefficient alphas ranging from .88 to .91 (Table 5). The meta-analysis of the *T*-alphas found an overall average internal consistency of .894, with a non-significant test of heterogeneity, Q (14) = 9.12, p = .365; I^2 = 7.88 %. This suggests that the reliability of the new GPS-9 was robust across the 15 samples tested, and that there was no need for moderation analyses.

The lack of significant tests of heterogeneity across all the analyses in Study 2 is notable, especially given the mixture of community, student and chronic illness samples in the analyses. These null findings provide solid evidence that the GPS-9 is a reliable short version of the original, longer 20-item measure, which retains its internal consistency across somewhat diverse samples.

General Discussion

The aim of the current research was to develop and validate a short and reliable version of the GPS that could be used in situations where participant burden may discourage the use of the full 20-item scale when assessing dispositional procrastination. Across two studies that included diverse sets of samples, we found support for the validity of a short 9-item version of the GPS, with the expected associations with a set of known correlates and consequential outcomes of the full scale. Tests of test-retest reliability were very good and comparable if not better than those for the full GPS over a slightly longer period of time, and supported the overall stability of the measure over a two-week period. In addition, the meta-analysis of the coefficient alphas of the new GPS-9 scale across 15 samples provided solid

evidence of not only the reliability of the new GPS-9, but also of the generalisability of its reliability across student, adult and chronic illness samples of varying ages and gender compositions. Overall, the current studies provide initial support for the validity and reliability of a shorter and more time efficient measure of dispositional procrastination, the GPS-9.

There are several limitations worth noting when considering the findings of the current research. First, the factor analysis used to extract the new items for the scale assumed a unidimensional factors structure for the GPS. There is some controversy over whether this is the case as one confirmatory factor analysis failed to find good fit indices for a unidimensional model with the full GPS (Svartdal & Steel, 2017). However, this same analysis did not find strong support for a multidimensional structure either. As there were a number of other procrastination scales administered at the same time, participant fatigue may have contributed to the inconclusive findings regarding the factor structure of the full GPS. Nonetheless, in the current study, the scree plot obtained for both samples that were used to extract items showed no signs of a multidimensional factor structure as suggested by other researchers. This, and the very good internal consistency of the new GPS-9 found across all 15 samples provides support the unidimensionality of this shorter version of the GPS.

Second, although correlation tests of the GPS-9 were conducted with a set of variables known to be part of the nomological network of the full GPS, only a limited set was examined. Therefore, it is unknown how the GPS-9 will relate to other variables within this nomological network (e.g., impulsivity, rumination, self-control) or to behavioural measures of procrastination. Further research is needed to test these associations. Lastly, the full GPS is known to have excellent stability over a 10-year period (Steel, 2007). In the current study the test-retest reliability of the new GPS-9 was tested over a relative short period of time given

that the scale measures trait procrastination. It is unclear how it would perform in terms of stability over longer intervals of time.

Despite these limitations, the current research has several notable strengths. First, the initial extraction of items followed classic scale construction guidelines (Field, 2005; Kline, 1994; Widaman et al., 2011), and was conducted across two large samples, which replicated the items chosen, and thus increased confidence in the selections made. Second, the psychometric properties of the new GPS-9 were tested across diverse samples and construct validity tests demonstrated that the GPS-9 had associations that were similar in magnitude to those obtained with the full GPS. This helped provide some initial support for the construct validity of the new shorter scale which cannot be assumed simply because the scale shows good reliability (John & Soto, 2007). Lastly, the reliability of the GPS-9 was tested and statistically meta-analysed across 15 samples, demonstrating that its internal consistency is not significantly affected by the differences in sample characteristics. This latter strength is especially important as one of the aims in creating the GPS-9 was to provide a brief measure that could be used with clinical and medical populations for which participant burden is an important consideration.

Acknowledgment and interest in the health consequences of trait procrastination has risen substantially in recent years. Consequently, research into the how and why trait procrastination may create additional vulnerability for medical populations with already compromised self-regulation capacities, such as those with cardiovascular disease (Sirois, 2015), or chronic pain (Beauregard, Ioachim, & Sirois, 2015), is both import and necessary to reduce health complications and improve well-being. Findings from the current research indicates that the GPS-9 can provide a brief, valid, and reliable measurement of trait procrastination that can be used by researchers working with both general and medical populations to better understand the correlates and consequences of trait procrastination.

References

Balkis, M., & Duru, E. (2015). Procrastination, self-regulation failure, academic life satisfaction, and affective well-being: underregulation or misregulation form. *European Journal of Psychology of Education, 31*, 439–459. doi:10.1007/s10212-015-0266-5

Beauregard, J., Ioachim, G., & Sirois, F. M. (2015). *Trait procrastination negatively impacts coping with fibromyalgia* Paper presented at the 9th annual Procrastination Research Conference, Bielefeld, Germany.

Blunt, A., & Pychyl, T. A. (1998). Volitional action and inaction in the lives of undergraduate students: State orientation, procrastination and proneness to boredom. *Personality and Individual Differences, 24*, 837-846. doi:10.1016/S0191-8869(98)00018-X

Borenstein, M., Hedges, L., Higgins, J., & Rothstein, H. (2005). Comprehensive Meta-analysis (Version 2). Englewood NJ: Biostat.

Card, N. A. (2012). *Applied meta-analysis for social science research*. New York, NY: Guilford Press.

Cattell, R. B. (1978). *The scientific use of factor analysis*. New York: Plenum.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*(4), 385-396.

Cohen, S., & Williamson, G. (1988). Perceived stress in a probability sample of the United States. In S. Spacapan & S. Oskamp (Eds.), *The social psychology of health: Claremont Symposium on applied social psychology*. Newbury Park, CA: Sage.

Crawford, J. R., & Henry, J. D. (2004). The Positive and Negative Affect Schedule (PANAS): Construct validity, measurement properties and normative data in a large non-clinical sample. *British Journal of Clinical Psychology, 43*(3), 245-265.

Dimsdale, J. E. (2008). Psychological stress and cardiovascular disease. *Journal of the American College of Cardiology, 51*(13), 1237-1246. doi:https://doi.org/10.1016/j.jacc.2007.12.024

Evers, A. W. M., Verhoeven, E. W. M., van Middendorp, H., Sweep, F. C. G. J., Kraaimaat, F. W., Donders, A. R. T., . . . van Riel, P. L. C. M. (2013). Does stress affect the joints? Daily stressors, stress vulnerability, immune and HPA axis activity, and short-term disease and symptom fluctuations in rheumatoid arthritis. *Annals of the Rheumatic Diseases*.

Ferrari, J. R. (1989). Reliability of academic and dispositional measures of procrastination. *Psychological Reports, 64*, 1057-1058.

Ferrari, J. R., Díaz-Morales, J. F., O'Callaghan, J., Díaz, K., & Argumedo, D. (2007). Frequent behavioral delay tendencies by adults: International prevalence rates of chronic procrastination. *Journal of Cross-Cultural Psychology, 38*(4), 458-464. doi:https://doi.org/10.1177/0022022107302314

Ferrari, J. R., O'Callaghan, J., & Newbegin, I. (2005). Prevalence of procrastination in the United States, United Kingdom, and Australia: Arousal and avoidance delays in adults. *North American Journal of Psychology, 7*, 1-6.

Field, A. (2005). *Discovering statistics using SPSS* (Second ed.): Sage.

Flett, A. L., Haghbin, M., & Pychyl, T. A. (2016). Procrastination and depression from a cognitive perspective: An exploration of the associations among procrastinatory automatic thoughts, rumination, and mindfulness. *Journal of Rational-Emotive & Cognitive-Behavior Therapy, 34*(3), 169-186. doi:10.1007/s10942-016-0235-1

Flett, G. L., Stainton, M., Hewitt, P., Sherry, S., & Lay, C. (2012). Procrastination automatic thoughts as a personality construct: An analysis of the procrastinatory cognitions inventory. *Journal of Rational-Emotive & Cognitive-Behavior Therapy*, 1-14. doi:10.1007/s10942-012-0150-z

Guadagnoli, E., & Velicer, W. F. (1988). Relation of sample size to the stability of component patterns. *Psychological Bulletin, 103*(2), 265-275.

Gupta, R., Hershey, D. A., & Gaur, J. (2012). Time perspective and procrastination in the workplace: An empirical investigation. *Current Psychology, 31*(2), 195-211. doi:10.1007/s12144-012-9136-3

Gustavson, D. E., Miyake, A., Hewitt, J. K., & Friedman, N. P. (2014). Genetic relations among procrastination, impulsivity, and goal-management ability: Implications for the evolutionary origin of procrastination. *Psychological Science*.

Hen, M., & Goroshit, M. (2014). Academic procrastination, emotional intelligence, academic self-efficacy, and GPA: A comparison between students with and without learning disabilities. *Journal of Learning Disabilities, 47*, 116-124. doi:10.1177/0022219412439325

Hen, M., & Goroshit, M. (2018). General and life-domain procrastination in highly educated adults in Israel. *Frontiers in Psychology, 9*(1173). doi:10.3389/fpsyg.2018.01173

Hewitt, P., Flett, G., & Mosher, S. (1992). The Perceived Stress Scale: Factor structure and relation to depression symptoms in a psychiatric sample. *Journal of Psychopathology and Behavioral Assessment, 14*(3), 247-257. doi:10.1007/BF00962631

Higgins, J. P. T., & Thompson, S. G. (2002). Quantifying heterogeneity in a meta-analysis. *Statistics in Medicine, 21*(11), 1539-1558. doi:10.1002/sim.1186

John, O. P., & Soto, C. J. (2007). The importance of being valid: Reliability and the process of construct validation. In R. W. Robins, R. C. Fraley, & R. F. Krueger (Eds.),

Handbook of research methods in personality psychology (pp. 461-494). New York, NY, US: Guilford.

Kline, P. (1994). *An easy guide to factor analysis*. London: Routledge.

LaVoie, J. A., & Pychyl, T. A. (2001). Cyberslacking and the procrastination superhighway: A web-based survey of online procrastination, attitudes, and emotion. *Social Science Computer Review, 19*(4), 431-444.

Lay, C. H. (1986). At last, my research article on procrastination. *Journal of Research in Personality, 20*, 474-495. doi:10.1016/0092-6566(86)90127-3

Lay, C. H. (1992). Trait procrastination and the perception of person-task characteristics. *Journal of Social Behavior and Personality, 7*(3), 483-494.

Lay, C. H. (1997). Explaining lower-order traits through higher order factors: The case of trait procrastination, conscientiousness, and the specificity dilemma. *European Journal of Personality, 11*(4), 267-278. doi:https://doi.org/10.1002/(SICI)1099-0984(199711)11:4<267::AID-PER281>3.0.CO;2-P

Martin, T. R., Flett, G. L., Hewitt, P. L., Krames, L., & Szanto, G. (1996). Personality correlates of depression and health symptoms: A test of a self-regulation model. *Journal of Research in Personality, 30*(2), 264-277.

Meeus, M., & Nijs, J. (2007). Central sensitization: a biopsychosocial explanation for chronic widespread pain in patients with fibromyalgia and chronic fatigue syndrome. *Clinical Rheumatology, 26*(4), 465-473. doi:10.1007/s10067-006-0433-9

Nicassio, P. M., Moxham, E. G., Schuman, C. E., & Gevirtz, R. N. (2002). The contribution of pain, reported sleep quality, and depressive symptoms to fatigue in fibromyalgia. *Pain, 100*(3), 271-279. doi:https://doi.org/10.1016/S0304-3959(02)00300-7

Rammstedt, B., & John, O. P. (2007). Measuring personality in one minute or less: A 10-item short version of the Big Five Inventory in English and German. *Journal of Research in Personality, 41*(1), 203-212. doi:http://dx.doi.org/10.1016/j.jrp.2006.02.001

Rodriguez, M. C., & Maeda, Y. (2006). Meta-analysis of coefficient alpha. *Psychological Methods, 11*, 306-322.

Sirois, F. M. (2007). ‘‘I’ll look after my health, later’’: A replication and extension of the procrastination–health model with community-dwelling adults. *Personality and Individual Differences, 43*, 15-26. doi:10.1016/j.paid.2006.11.003

Sirois, F. M. (2014a). Out of sight, out of time? A meta-analytic investigation of procrastination and time perspective. *European Journal of Personality, 28*, 511-520 doi:10.1002/per.1947

Sirois, F. M. (2014b). Procrastination and stress: Exploring the role of self-compassion. *Self and Identity, 13*(2), 128-145. doi:10.1080/15298868.2013.763404

Sirois, F. M. (2015). Is procrastination a vulnerability factor for hypertension and cardiovascular disease? Testing an extension of the procrastination-health model *Journal of behavioral medicine, 38*, 578-589. doi:https://doi.org/10.1007/s10865-015-9629-2

Sirois, F. M. (2016). Procrastination, stress, and chronic health conditions: A temporal perspective. In F. M. Sirois & T. Pychyl (Eds.), *Procrastination, Health, and Well-Being* (pp. 67–92). London, UK: Academic Press.

Sirois, F. M., & Giguère, B. (2018). Giving in when feeling less good: Procrastination, action control, and social temptations. *British Journal of Social Psychology, 57*(2), 404-427. doi:10.1111/bjso.12243

Sirois, F. M., & Kitner, R. (2015). Less adaptive or more maladaptive? A meta-analytic investigation of procrastination and coping. *European Journal of Personality, 29*, 433–444. doi:10.1002/per.1985

Sirois, F. M., Melia-Gordon, M. L., & Pychyl, T. A. (2003). "I'll look after my health, later": An investigation of procrastination and health. *Personality and Individual Differences, 35*(5), 1167-1184. doi:10.1016/S0191-8869(02)00326-4

Sirois, F. M., & Pychyl, T. A. (2013). Procrastination and the priority of short-term mood regulation: Consequences for future self. *Social and Personality Psychology Compass, 7*(2), 115-127. doi:10.1111/spc3.12011

Sirois, F. M., Stride, C. B., & Pychyl, T. A. (forthcoming). A longitudinal test of the procrastination-health model.

Solberg Nes, L., Roach, A. R., & Segerstrom, S. C. (2009). Executive functions, self-regulation, and chronic pain: A review. *Annals of Behavioral Medicine, 37*(2), 173-183. doi:10.1007/s12160-009-9096-5

Stanton, J. M., Sinar, E. F., Balzer, W. K., & Smith, P. C. (2006). Issues and strategies for reducing the length of self-report scales. *Personnel Psychology, 55*(1), 167-194. doi:10.1111/j.1744-6570.2002.tb00108.x

Stead, R., Shanahan, M. J., & Neufeld, R. W. J. (2010). "I'll go to therapy, eventually": Procrastination, stress and mental health. *Personality and Individual Differences, 49*(3), 175-180. doi:https://doi.org/10.1016/j.paid.2010.03.028

Steel, P. (2007). The nature of procrastination: A meta-analytic and theoretical review of quintessential self-regulatory failure. *Psychological Bulletin, 133*(1), 65–94. doi:10.1037/0033-2909.133.1.65

Svartdal, F., Granmo, S., & Færevaag, F. S. (2018). On the behavioral side of procrastination: Exploring behavioral delay in real-life settings. *Frontiers in Psychology, 9*(746). doi:10.3389/fpsyg.2018.00746

Svartdal, F., & Steel, P. (2017). Irrational delay revisited: Examining five procrastination scales in a global sample. *Frontiers in Psychology, 8*, 1927-1927. doi:10.3389/fpsyg.2017.01927

Van Eerde, W. (2003). A meta-analytically derived nomological network of procrastination. *Personality and Individual Differences, 35*, 1401–1418. doi:https://doi.org/10.1016/S0191-8869(02)00358-6

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*, 1063-1070. doi:10.1037/0022-3514.54.6.1063

Widaman, K. F., Little, T. D., Preacher, K. J., & Sawalani, G. M. (2011). On creating and using short forms of scales in secondary research. In K. H. Trzesniewski, M. B. Donnellan, & R. E. Lucas (Eds.), *Secondary data analysis: An introduction for psychologists* Washington, DC, US: American Psychological Association.

Table 1. *Factor Loadings for the 20 item General Procrastination Scale Across Two Samples*

Item	Sample loadings	
	Sample 1 (n = 620)	Sample 2 (n = 920)
12. In preparing for some deadlines, I often waste time by doing other things.	**.751**	**.724**
19. I am continually saying I'll do it tomorrow.	**.751**	**.767**
15. I often have a task finished sooner than necessary.	**-.741**	**-.726**
9. I generally delay before starting work I have to do.	**.739**	**.739**
18. I usually accomplish all the things I plan to do in a day.	**-.724**	**-.687**
20. I usually take care of all the tasks I have to do before I settle down and relax for the evening.	**-.714**	**-.687**
7. Even with jobs that require little else except sitting down and doing them, I find they seldom get done for days.	**.710**	**.729**
1. I often find myself performing tasks that I had intended to do days before.	**.657**	**.621**
17. I usually buy even an essential item at the last minute.	**.649**	**.648**
14. I usually return a R.S.V.P. request very shortly after receiving it.	-.581	-.592
5. Sometimes it takes me days to get around to responding to my (e)mail.	.570	.524
8. I usually make decisions as soon as possible.	-.565	-.590
16. I always seem to end up shopping for birthday gifts at the last minute.	.562	.620
3. When planning a party, I make the necessary arrangements well in advance.	-.534	-.607
10. When traveling, I usually have to rush to arrive at the airport or station at the appropriate time.	.516	.516
2. I often miss concerts, sporting events, or the like, because I don't get around to buying tickets on time	.501	.533
13. If a bill for a small amount comes, I pay it right away.	-.494	-.472
4. When it is time to get up in the morning, I most often get right out of bed.	-.480	-.477
6. I generally return phone calls promptly.	-.471	-.519
11. When preparing to go out, I am seldom caught having to do something at the last minute.	-.340	-.423

Note: Factor loadings were obtained using a principal components extraction.

Table 2.

Demographic Characteristics of the Fifteen Samples

				Age (years)		Education level (%)		
Sample	*N*	Percent female	Percent white	*M*	*SD*	High school	College/ university	Graduate school
1	178	89.3	84.0	41.99	14.03	17.0	64.4	18.7
2	83	84.3	93.4	35.04	14.94	12.0	61.5	26.5
3	729	68.4	86.0	30.44	12.22	8.8	51.1	40.1
4	108	81.5	76.6	32.02	15.31	6.5	73.1	20.4
5	142	76.8	89.7	29.74	13.34	--	92.6	7.1
6	455	71.4	77.4	23.30	6.69	13.2	61.4	25.5
7	333	77.2	75.0	30.11	26.68	0.0	77.6	21.5
8	50	62.0	100.0	20.86	0.97	0.0	100.0	0.0
9	411	78.3	84.5	29.04	10.88	8.1	55.8	36.2
10	162	67.3	88.9	37.97	13.13	6.8	46.5	46.6
11	386	77.5	77.4	26.91	12.23	9.9	68.1	22.0
12	301	100	86.4	24.55	5.45	6.6	57.1	36.2
13	322	78.0	85.2	28.67	10.75	8.4	52.2	38.8
14	484	77.7	78.2	27.93	11.61	11.2	62.9	26.0
15	348	72.7	76.4	28.81	12.78	17.6	54.9	27.4

Table 3

Summary of the Characteristics of GPS-9 with Personality and Affect Variables

		Conscientiousness			**Neuroticism**			**Positive affect**			**Negative affect**			**Perceived Stress**		
S	N	*M*	*(SD)*	α	*M*	*(SD)*	α	*M*	*(SD)*	α	*M*	*(SD)*	α	*M*	*(SD)*	α
1	178	3.76	.87	.32	3.60	1.04	.63							3.40	.79	.91
2	65	3.75	.90	.51	3.40	1.10	.76	---	---	---	---	---	---	3.34	.67	.87
3	729	---	---	---	---	---	---	4.68	1.47	.80	2.87	1.49	.87	---	---	---
4	108	---	---	---	---	---	---	48.29	24.23	.84	33.58	21.86	.80	---	---	---
5	142	---	---	---	---	---	---	2.60	0.75	.63	1.60	.69	.63	3.02	.70	.88
6	455	---	---	---	---	---	---	2.44	0.87	.67	1.83	0.77	.56	---	---	---
9	411	---	---	---	---	---	---	3.65	1.01	.77	2.43	1.05	.85	2.97	0.69	.89
10	162	---	---	---	---	---	---	3.43	1.03	.79	2.35	1.00	.86	2.90	0.70	.89
13	322	---	---	---	---	---	---	3.63	0.99	0.74	2.44	1.06	.86	2.97	.69	.89
15	348	---	---	---	---	---	---	2.80	.84	.90	1.76	.82	.92	3.00	.68	.88

Note: *The score of positive and negative items in Sample 4 ranged from 1 to 100; Samples 7, 8, 11, 12, and 14 did not include any of the above personality and affect variables ns thus were omitted from the table.

Table 4

Correlations of GPS-9 with Personality and Affect Variables

Sample	***N***	Conscientiousness	Neuroticism	Positive affect	Negative affect	Stress
1	178	-.421**	.201**	---	---	.410**
2	83	-.434**	.349**	---	---	.584**
3	729	---	---	-.283**	.337**	---
4	108	---	---	-.272**	.351**	---
5	142	---	---	-.180**	.121	.314**
6	455	---	---	-.368**	.300**	---
9	411	---	---	-.263**	.297**	.428**
10	162	---	---	-.311**	.422**	.424**
13	322	---	---	-.231**	.321**	.429**
15	348	---	---	-.290**	.310**	.399**

Note: ** $p < .07$; Samples 7, 8, 11, 12, and 14 did not include any of the above personality and affect variables and thus were omitted from the table.

Table 5

Descriptives and Meta-Analyzed Coefficient Alphas for the GPS-9, k = 15, N = 4,492.

Sample	Sample type	*N*	*M*	*(SD)*	α	95% CI
1	Chronic illness	178	3.30	.81	.880	[.85, .91]
2	Chronic illness	83	3.24	.85	.909	[.88, .94]
3	Community	729	3.10	.81	.903	[.89, .91]
4	Community	108	2.92	.79	.888	[.85, .92]
5	Student + Community	142	3.00	.83	.905	[.88, .93]
6	Student	455	3.16	.77	.895	[.88, .91]
7	Community	333	3.04	.77	.883	[.86. .90]
8	Student	50	3.05	.62	.863	[.80, .91]
9	Community	411	3.12	.82	.898	[.88, .91]
10	Community	162	3.42	.73	.881	[.85, .91]
11	Community	386	3.09	.76	.887	[.87, .90]
12	Community	301	3.10	.80	.900	[.88, .92]
13	Community	322	3.13	.84	.901	[.88, .92]
14	Community	484	3.05	.83	.895	[.88, .91]
15	Community	348	3.16	.75	.876	[.86, .89]
	Total	4,492		M_{alpha}	.894	[.89, .90]
				$Q(14)$	15.20	
					$p = .365$	
				I^2	7.88	

Note: The meta-analysis used the *T* (transformed) coefficient alpha values, which were then converted back to coefficient alpha for ease of interpretation.

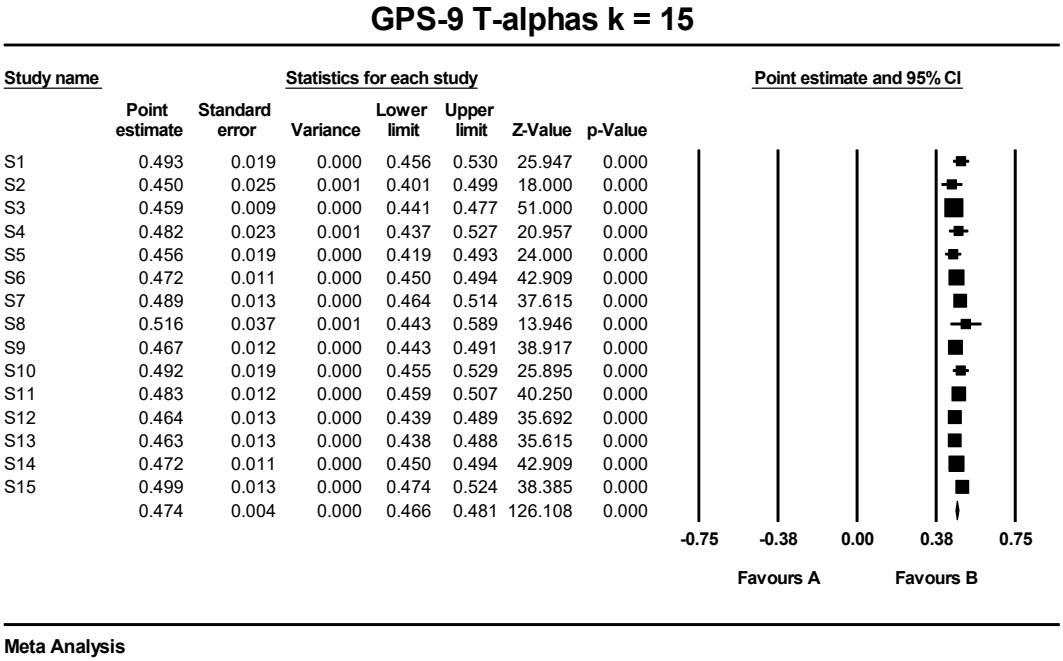

Figure 1: Forest plot of the transformed coefficient alphas (T-alphas) across 15 samples.