CHAPTER 5

Do Perceptions of Remaining Life Shape Procrastination? Evidence from Latent Class and Bayesian Models

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Abstract: Procrastination is linked to temporal orientation, with stronger future orientation typically associated with lower procrastination. However, it remains unclear whether subjective remaining life is associated with procrastination. This study examined associations between temporal orientation, subjective remaining life, and procrastination in a sample of 140 adults aged 18–77. Latent class analysis identified two temporal profiles: a high future orientation group (46.43%) and a neutral orientation group (53.37%). Bayesian regression indicated that higher subjective remaining life was likely associated with greater procrastination, although the effect was modest. In contrast, future orientation showed a clear negative association with procrastination. These findings suggest that subjective remaining life may function as a contextual factor, whereas temporal orientation represents a more robust correlate of procrastination.

5.1 Introduction

Procrastination, the voluntary and irrational delay of intended actions despite expecting to be worse off for the delay (Klingsieck, 2013b; Sirois & Pychyl, 2013), represents a form of self-regulatory failure with well-documented costs for psychological well-being, health, and goal attainment (Sirois & Pychyl, 2016b; Stead et al., 2010). Although often studied as a relatively stable individual difference (Meng et al., 2024) procrastination is inherently temporal (Borawski et al., 2026; Sirois & Pychyl, 2013). It involves repeated decisions to prioritise the needs of the present self over the needs of the future self (Sirois & Pychyl, 2013). As such, procrastination has been previously conceptualised as a form of temporal misalignment (Díaz-Morales & Ferrari, 2015; Díaz-Morales et al., 2008; J. R. Ferrari & Díaz-Morales, 2007b).

This temporal misalignment may be particularly consequential in older adulthood. Whereas delays in youth often involve reversible costs, procrastination in later life can carry more enduring consequences for health, financial security, and autonomy (Monaghan et al., 2025; Shah & Mukherjee, 2025). Additionally, ageing coincides with systematic changes in how individuals perceive and relate to time. Chronic procrastinators report feeling less connected to their future self (Sirois, 2014a; Sirois & Pychyl, 2016b; Specter & Ferrari, 2000) and engage less in future-oriented planning (J. R. Ferrari & Díaz-Morales, 2007b), suggesting that individual differences in temporal cognition may play a central role in sustaining procrastinatory behavior.

One mechanism thought to maintain procrastination is unrealistic optimism regarding the future self. Procrastinators tend to assume that the future self will be more motivated, disciplined, or capable of completing delayed tasks (Sirois & Pychyl, 2016b). When these expectations fail to materialise, the resulting gap between intention and action generates negative affect, including guilt, frustration, and self-blame (A. Blunt & Pychyl, 2005; Fee & Tangney, 2000; B. McCown et al., 2012), reinforcing the cycle of delay. Understanding the factors that influence this temporal disconnection is therefore critical for explaining why individuals continue to delay action in ways that undermine their long-term well-being.

5.1.1 Consideration of future consequences

A central construct for measuring individual differences in temporal motivation is consideration of future consequences (CFC; Strathman et al., 1994). CFC measures the extent to which individuals weigh future rewards versus immediate rewards when making decisions (Rebetez et al., 2016). Individuals high in CFC are more likely to prioritise delayed but meaningful rewards, engage in goal-directed behavior, and invest effort in outcomes that benefit their long-term welfare (Boyd & Zimbardo, 2012; Milfont & Schwarzenthal, 2014). Conversely, those low in CFC tend to focus on short-term gratification and impulsive action (Joireman et al., 2005).

Consistent with this framework, procrastination is robustly and negatively associated with CFC (Rebetez et al., 2016; Sirois, 2004, 2014a). Individuals who place greater weight on future consequences tend to plan ahead and persist in aversive tasks, whereas those low in CFC are more prone to avoidance and delay. Meta-analytic evidence (Sirois, 2014a) across 14 independent samples, including three studies directly assessing CFC, reports a reliable negative association between procrastination and future time perspective ($\bar{r} = -0.45, p < 0.001$). These findings underscore the importance of temporal orientation as a dispositional correlate of procrastination.

However, CFC captures "*how strongly individuals value future outcomes*", not "*how much future time they believe they have*". Broader perceptions of future time may therefore provide an important contextual frame within which CFC operates. In particular, beliefs about one's remaining lifetime may shape the motivational salience of future consequences and, by extension, the extent to which future-oriented dispositions translate into action.

5.1.2 Subjective remaining life

According to Socioemotional Selectivity Theory (Carstensen, 2001), individuals continuously monitor their perceived time left to live (i.e., their subjective remaining life) and adjust their goals and motivational priorities accordingly. When individuals perceive time as expansive, they are more likely to focus on knowledge acquisition, growth, and long-term rewards. However, as this time begins to shorten individuals tend to prioritise emotionally meaningful and immediate experiences (Kaftan & Freund, 2018).

These shifts have implications for procrastination. An expansive time horizon may encourage long-term planning and investment (Kornadt et al., 2018), but it may also reduce perceived urgency for completing aversive or obligatory tasks (i.e., tasks most susceptible to procrastination). In contrast, a limited time horizon may heighten urgency and promote more efficient allocation of effort (Hasmanová Marhánková & Soares Moura, 2024), potentially reducing delay. Thus, subjective remaining life may exert both facilitating and inhibiting influences on procrastination, depending on how future outcomes are weighted.

5.1.3 Subjective remaining life and consideration of future consequences

Despite their overlap, subjective remaining life and CFC have not been examined together in the context of procrastination. Importantly, the two constructs capture distinct aspects of temporal cognition. Subjective remaining life measures "how much time is believed to remain", whereas CFC measures "the degree to which future outcomes influence present behavior". These dimensions may interact in shaping self-regulatory decisions.

For example, individuals who perceive a long remaining lifetime but place little weight on future consequences may be especially prone to procrastination, viewing delayed action as inconsequential given ample time ahead. By contrast, those with a similarly expansive time horizon but high CFC may to plan and act in accordance with long-term goals. Conversely, those who perceive a short remaining lifetime but with high CFC may reduce procrastination by amplifying both urgency and commitment to goal fulfilment. In this way, subjective remaining life may define the temporal context within which dispositional future orientation influences procrastinatory behavior.

5.1.4 The present study

The present study examines how subjective remaining life relates to procrastination and whether this association is moderated by individual differences in consideration of future consequences. We hypothesised that individuals with a longer subjective remaining life would report greater procrastination, reflecting a reduced sense of temporal urgency. Furthermore, we expected that this relationship would depend on individuals' level of CFC: those low in CFC would show a stronger positive association between subjective remaining life and procrastination, while those high in CFC would exhibit a weaker or null relationship due to their stronger future-oriented motivation.

5.2 Method

5.2.1 Design and participants

This is an analysis of cross-sectional survey data recruited through both convenience and snowball sampling methods. The initial sample comprised 229 respondents. However, 90 respondents were excluded from analysis due to either high levels of missing data across all variables ($\geq$ 80% missingness; $n = 87$) or missing data in key covariates ($n = 3$). As such, the final analytic sample comprised 140 respondents.

5.2.2 Measures

Predictor: Consideration of future consequences

Consideration of future consequences (CFC) was assessed using the CFC-14 scale (Joireman et al., 2012). This scale consists of two 7-item subscales: CFC-Future (CFC-F) and CFC-Immediate (CFC-I). Items are measured on a 7-point Likert scale ranging from 1 (not at all like me) to 7 (very much like me). Subscale scores (range: $7 - 49$) were computed by summing the respective items, and a total CFC score (range: $14 - 98$) was calculated by reverse-scoring CFC-I items and combining them with CFC-F. Within this sample, the reliability of both subscales was strong, with Cronbach's α values of 0.85 for CFC-F and 0.81 for CFC-I. An example item from the CFC-F

subscale includes, "I am willing to sacrifice my immediate happiness or well-being in order to achieve future outcomes", while an example item from the CFC-I subscale includes, "I think that sacrificing now is usually unnecessary since future outcomes can be dealt with at a later time".

Predictor: Subjective remaining life

Subjective remaining life (SRL) was operationalised following established approaches in lifespan and ageing research (Kornadt et al., 2018). SRL was calculated as the difference between participants' subjective life expectancy and their current age, with higher values indicating a perception of having more remaining lifetime. Subjective life expectancy was assessed using two questions adapted from the Healthy AGeing in Scotland study (Douglas et al., 2018). Participants first estimated the average life expectancy of others their age and sex, then provided their own life expectancy.

Outcome: Procrastination

Procrastination was measured using the Pure Procrastination Scale (PPS; Steel, 2010). Each item is measured on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A composite procrastination score (range: $12 - 60$) is calculated by summing each item. In this sample, the PPS demonstrated strong reliability with a Cronbach's α score of 0.90. An example of an item from the scale includes "I delay making decisions until it's too late".

Covariates

Three covariates, sex, presence of a chronic illness, and self-rated general health were included in the analysis based on a priori knowledge of their associations with procrastination and self-regulatory behaviour (Sirois & Kitner, 2015; Steel & Ferrari, 2013). All covariates were dichotomized such that: sex (0 = male, 1 = female), chronic illness (0 = absent, 1 = present), and self-rated general health (0 = poor health, 1 = good health).

5.2.3 Procedure

The study was approved by the departmental review board at Maynooth University. Participation in the study was both voluntary and anonymous. Participants provided informed consent before completing the online survey, which was administered via Qualtrics, ensuring secure data handling through encryption and compliance with data protection standards.

5.2.4 Data Analysis

All data analysis was carried out using R (version 4.5.2; R Core Team, 2025).

Latent class analysis

A latent class analysis (LCA) was conducted to identify unobserved heterogeneity in respondents' temporal orientation based on their response patterns to the CFC-14 item. LCA is a model-based clustering approach for categorical data that assumes the observed multivariate distribution arises from a finite mixture of latent subpopulations, each characterised by distinct response probabilities across the observed indicators (Kaplan, 2008; Sinha et al., 2021).

To facilitate estimation and address insufficient degrees of freedom associated with the full seven-point response scale, CFC-14 items were trichotomised prior to analysis (see Equations (A.1) to (A.3) in the Appendix). Responses ranging from 1 – 3 (representing negatively worded answers) were recoded as 1. The response 4, representing neither agreement nor disagreement was recoded as 2. Finally, responses ranging from 5 – 7 (representing positively worded answers) were recoded as 3.

LCA was performed using the `PoLCA` package (Linzer & Lewis, 2011). A series of models with a number of latent classes ranging from $R \in \{1, 2, 3, 4\}$ were fit. Following recommendations to mitigate convergence on local maxima (Meijer et al., 2022), each model was estimated with a maximum of 3,000 iterations and 100 random starting values. Model fit was assessed primarily by the Bayesian Information Criterion (BIC), which has been shown to perform well in latent class settings (Linzer & Lewis, 2011; Van Lissa et al., 2024), alongside normalised entropy as an index of classification certainty. Entropy values exceeding 0.80 were interpreted as indicating adequate separation between latent classes (Meijer et al., 2022). Rather than assigning individuals to classes using modal posterior probabilities, posterior class membership probabilities were retained. This approach explicitly accounts for classification uncertainty and avoids bias associated with treating latent class membership as an observed variable (see Asparouhov and Muthén, 2014).

Bayesian regression

Associations between temporal orientation, subjective remaining life, and procrastination were examined using Bayesian regression models implemented in JAGS via the `R2jags` package (Yu-Sung & Masanao, 2024). Posterior class probabilities from the LCA were used to propagate latent class uncertainty. Specifically, each participant's class membership was treated as a Bernoulli variable with success probability equal to their posterior probability of being in the non-reference class (π_i). This allowed the model to integrate uncertainty in class assignment directly into the regression.

The regression model included latent class membership, subjective remaining life (mean-centred), and their interaction as predictors, along with sex, self-rated general health, and chronic illness status as covariates. Statistically, let Y_i be the observed response variable for individual i. We assume the following:

$$\begin{aligned} y_i &\sim \mathcal{N}(\mu_i, \sigma^2) \\ \mu_i &\sim \beta_0 + \beta_1 \text{Class}_i + \beta_2 \text{SRL}_i + \beta_3 \text{Class}_i \times \text{SRL}_i + \\ &\quad \beta_4 \text{Sex}_i + \beta_5 \text{General Health}_i + \beta_6 \text{Chronic Illness}_i \\ \text{Class}_i &\sim \text{Bernoulli}(\pi_i) \end{aligned}$$

Weakly informative normal priors were placed on all regression coefficients, and a half-t prior was specified for the residual standard deviation.

$$\beta_k \sim \mathcal{N}(0, 100^2), \quad k = 0, \ldots, 6, \quad \sigma \sim \text{half-t}(0, 100, 1).$$

5.3 Results

Our final analytic sample comprised 140 respondents with the following age distribution: 18-24 ($n = 48$), 25-44 ($n = 46$), and 45+ ($n = 46$). Of these 140 respondents, 68.57% ($n = 96$) were female, 35.00% ($n = 49$) had a chronic illness, and 92.14% ($n = 129$) rated their health as good. Descriptive statistics for all continuous variables were generated and are presented below in Table 5.1

Table 5.1: *Descriptive statistics for all continuous variables.*

Variable	Mean (95% CI)	Std. Error	Median	SD	Range
Age	36.45 (33.88 – 39.02)	1.30	28.5	15.5	18 – 77
CFC-F	32.36 (31.00 – 33.76)	0.71	33	8.28	7 – 49
CFC-I	26.17 (24.82 – 27.53)	0.69	26	8.22	6 – 49
Procrastination	34.76 (32.83 – 36.68)	0.97	35	11.57	12 – 60

5.3.1 Latent class analysis

To determine a respondent's temporal orientation, we ran four latent class models and presented model fit indices for all four models in Table 5.2. The two-class model showed lower BIC values compared to all other R-class models, indicating improved fit. Additionally, the entropy value exceeded 0.80, suggesting clear class separation. Overall, the two-class model demonstrated a strong balance between model complexity and fit and the fit metrics are highlighted in bold.

Table 5.2: *Goodness-of-fit statistics for one to four class models*

Model	k	Log(L)	BIC	Entropy	Probability of class
1 class	28	-1920.06	3978.48	NA	
2 classes	**57**	**-1728.25**	**3738.18**	**0.91**	**0.536 / 0.464**
3 classes	86	-1666.62	3758.23	0.95	0.436 / 0.421 / 0.143
4 classes	115	-1625.76	3819.81	0.96	0.143 / 0.457 / 0.271 / 0.129

Note. k = Number of free parameters; Log(L) = Log-likelihood value; BIC = Bayesian Information Criterion.

Figure 5.1 displays posterior-averaged item-response profiles for the two latent classes. For each class, mean item responses were averaged across 500 posterior draws of class membership, with shaded bands indicating 95% posterior credible intervals. One class, comprising 45.1% of respondents ($n = 64$), showed consistently higher responses on CFC-Future items and lower responses on CFC-Immediate items, indicating a strong emphasis on future consequences. This class was labelled the *high future, low immediate orientation group*. The second class, comprising 54.9% of respondents ($n = 79$), exhibited relatively flat and mid-range responses across both subscales, suggesting neither a pronounced future nor immediate oriented temporal focus. As a result, this class was labelled the *neutral orientation group*.

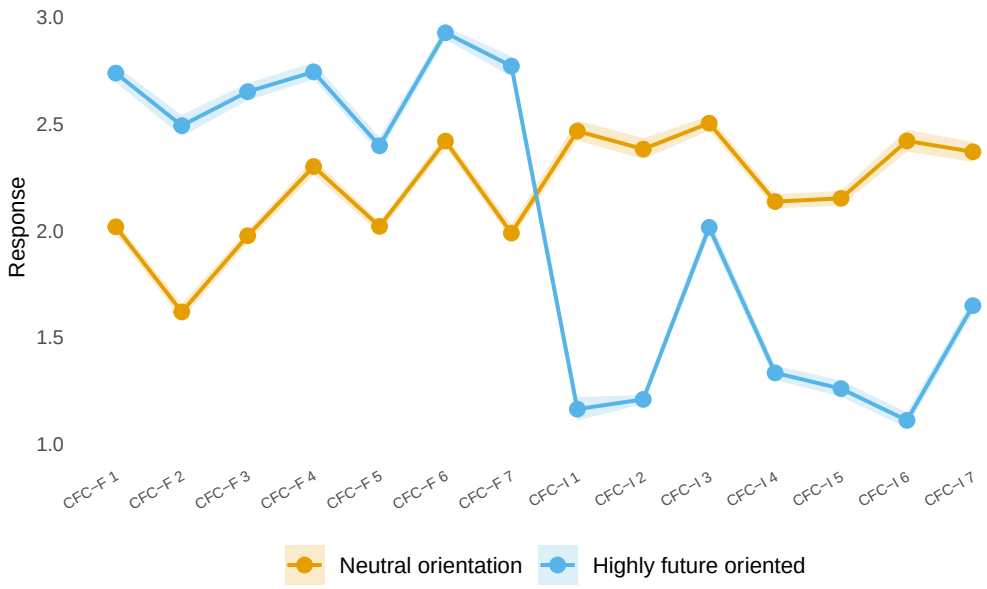

Figure 5.1: *Latent profile plot of posterior-averaged item-response profiles. Each point represents the mean item response averaged over 500 posterior draws of class membership, with shaded bands indicating 95% posterior credible intervals.*

5.3.2 Bayesian regression

Posterior distributions for all regression parameters are reported in Figure 5.2. For each parameter, the figure displays the posterior mean, 95% credible interval, and full posterior density, with estimates derived from the pooled posterior draws of the Bayesian regression model incorporating latent class uncertainty.

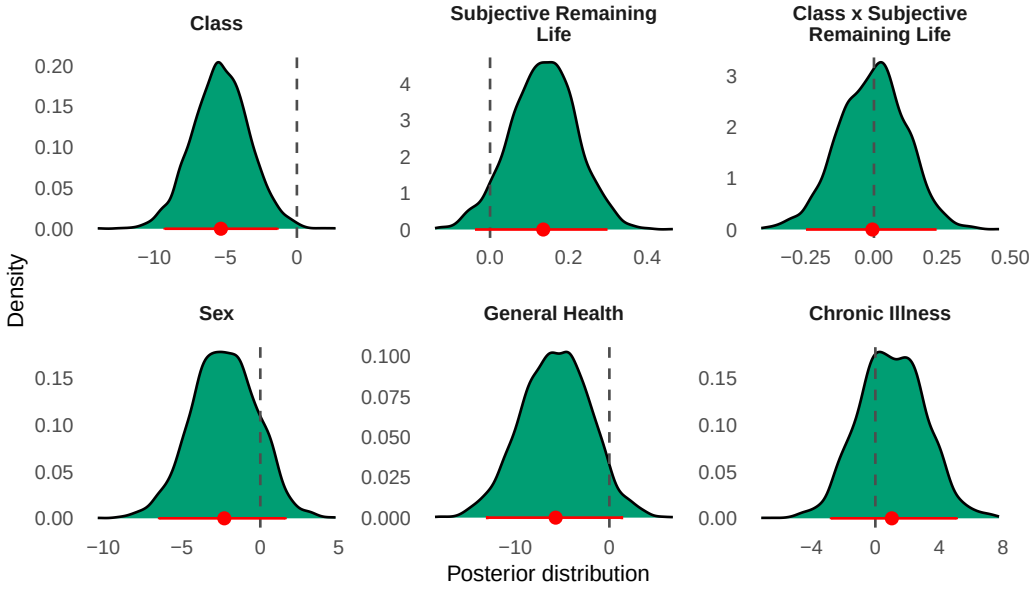

Figure 5.2: *Posterior distributions of Bayesian regression coefficients. Panels display marginal posterior densities for each predictor, with red points indicating posterior means and horizontal bars denoting 95% credible intervals. The dashed vertical line at zero represents the null value; intervals overlapping zero indicate uncertainty about the direction and magnitude of effects.*

Across most predictors, posterior estimates were modest in magnitude and characterised by substantial uncertainty. The interaction between temporal orientation class and subjective remaining life was close to zero and highly uncertain ($\beta = -0.01$ $[-0.25, 0.23]$). In contrast, the main effect for subjective remaining life showed a small positive association with procrastination ($\beta = 0.14$ $[-0.04, 0.30]$). Although the 95% credible interval overlapped zero, approximately 94% of posterior samples were greater than zero (see Figure 5.2), indicating moderate evidence for a positive association. Additionally, temporal orientation (i.e., class) exhibited a negative main effect on procrastination ($\beta = -5.33$ $[-9.28, -1.23]$) suggesting that individuals with a stronger future orientation tended to report lower procrastination scores.

With regard to the covariates, the effects for both sex ($\beta = -2.29$ $[-6.35, 1.61]$) and chronic illness ($\beta = 1.03$ $[-2.78, 5.09]$ were highly uncertain. In contrast, general health showed a moderate negative association with procrastination ($\beta = -5.71$ $[-13.00, 1.32]$) with approximately 95% of the posterior samples being less than zero, suggesting that those with reported good health tended to report lower

procrastinations. However, the relative abundance of respondents who reported poor health 7.69%($n = 11$) versus good health 92.31%($n = 129$) warrants caution in interpretation.

Consistent with these results, Figure 5.3 presents posterior predictive distributions of procrastination scores for both temporal orientation class (left panel) and subjective remaining life (right panel). While predicted procrastination scores were lower for individuals with a stronger future orientation (left panel), this difference had no meaningful effect on procrastination scores across subjective remaining life scores (right panel).

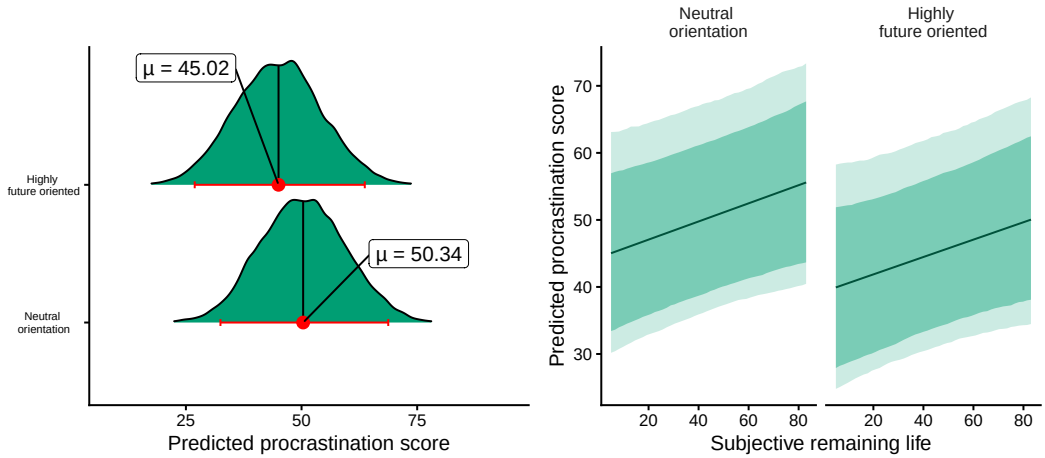

Figure 5.3: *Posterior predicted procrastination scores. The left panel shows scores stratified by temporal orientation class. The solid red points indicate the posterior mean and horizontal bars denoting the 95% credible intervals. Meanwhile, the right panel shows scores as a function of subjective remaining life. The shaded ribbons indicate the 80% and 95% credible intervals. All predictions are shown holding covariates constant at their reference levels.*

5.4 Discussion

While previous research has explored the temporal nature of procrastination (Rebetez et al., 2016; Sirois, 2004; Specter & Ferrari, 2000) no study has examined this nature across the lifespan, with a specific focus on subjective remaining life. Temporal orientation (how individuals perceive time) plays a significant role in shaping behaviour (Boyd & Zimbardo, 2012; Zimbardo & Boyd, 1999). Although studies such as those by Rebetez et al. (2016) highlight the role of future orientation in reducing procrastination, the intersection of temporal orientation and subjective remaining life (how much time one feels they have left) remains unexplored. Therefore, this study examined whether subjective remaining life was associated with procrastination, and whether it moderated the relationship between temporal orientation and procrastination.

Latent class analysis identified two distinct temporal orientation classes: a *high future orientation* group and a *neutral orientation* group. In line with prior research (Rebetez et al., 2016; Sirois, 2014a), temporal orientation showed a credible negative association with procrastination, such that individuals with a stronger future orientation reported lower procrastination scores (see Figure 5.3). Moreover, when it came to subjective remaining life, the results were more nuanced. Consistent with our hypothesis, the posterior mean suggested a positive association between subjective remaining life and procrastination, with approximately 94% of posterior samples indicated an effect in this direction. Although the magnitude of this association was modest and accompanied by interval uncertainty, the directional probability provides moderate evidence that perceiving more time left to live may be associated with greater procrastination.

Such results suggest that perceiving an expansive time horizon may reduce perceived urgency to act, thereby increasing susceptibility to delay. Individuals who perceive ample time remaining in life may feel less immediate pressure to act, reinforcing the tendency to defer effortful or aversive tasks to a future self. In this sense, subjective remaining life may contribute to the temporal misalignment that characterises procrastination (Borawski et al., 2026; Sirois & Pychyl, 2013). However, subjective remaining life did not appear to moderate the association between temporal orientation and procrastination. As seen from Figure 5.2, the posterior estimates for the interaction term were largely centred near zero. Moreover, predicted procrastination scores were broadly similar across levels of subjective remaining life within both temporal orientation classes (see Figure 5.3). Overall, the lack on an interaction effect and relatively small main effect size ($\beta = 0.14$) suggests that rather than acting as a dominant motivational factor, subjective remaining life may operate as a contextual factor that shapes how urgently future consequences are experienced. More broadly, procrastination be more strongly shaped by self-regulatory capacity, task characteristics, and personality traits such as conscientiousness (Meng et al., 2024; Sirois & Pychyl, 2013; Steel, 2007).

Taken together, these results tentatively suggest that perceiving a longer remaining lifetime may be associated with greater procrastination. However, from a Bayesian perspective, such an association is modest and warrants further investigation. Further research, particularly using longitudinal or experimental designs, is needed to determine whether changes in perceived remaining time translate into measurable shifts in procrastinatory behaviour. More importantly, while the present findings suggest that subjective remaining life may play a role in procrastination, this role is considerably weaker than that of stable future-oriented dispositions.

5.4.1 Limitations and future directions

Several limitations should be acknowledged. First, the cross-sectional nature of this study precludes causal inference and limits conclusions about temporal dynamics between subjective remaining life and procrastination. Longitudinal designs would be particularly valuable for examining whether changes in perceived time are associated with within-person changes in procrastination. Second, the relatively small sample size ($n = 140$) and use use of convenience sampling restricts generalisability. Although the sample spanned a wide age range ($18 - 77$), future research should aim to replicate these findings in both larger and more representative samples.

Moreover, our usage of the Pure Procrastination Scale (Steel, 2010) does not distinguish between different procrastination processes or task domains, but rather general procrastination tendencies. Future studies may benefit from examining domain-specific procrastination or task-level behaviour, particularly in contexts where future time perspectives are more salient (e.g., health decisions, retirement planning, or emotionally meaningful goals). Finally, future work should consider the role of individual differences such as conscientiousness, emotion regulation, and self-control (Meng et al., 2024; Steel, 2007), which may mediate or overshadow the effects of temporal orientation and subjective remaining life on procrastination.

5.4.2 Conclusions

This study examined whether subjective remaining life shapes the relationship between temporal orientation and procrastination. Using latent class analysis and Bayesian regression, we found strong evidence that stronger future orientation is associated with lower procrastination. Subjective remaining life showed moderate evidence of a small positive association with procrastination but did not moderate the relationship between temporal orientation and procrastination. Overall, these findings suggest that stable temporal orientation may play a more substantial role in procrastination than subjective perceptions of remaining life time.

CRediT authorship contribution statement

Cormac Monaghan: Conceptualisation, Methodology, Formal analysis, Visualisation, Writing - Original Draft, Writing - Review & Editing. **Ciarán Gartlan:** Conceptualisation, Data Curation, Writing - Review & Editing. **Rafael de Andrade Moral:** Methodology, Formal analysis, Supervision, Writing - Review & Editing. **Joanna McHugh Power:** Conceptualisation, Methodology, Formal analysis, Supervision, Writing - Review & Editing.