Reducing Fatigue Through Cognitive Bias Modification: A Pilot Study on the Role of Stress Vulnerability

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Abstract

This study investigated the relationship between perceived stress, fatigue, and interpretation bias, and examined whether a brief cognitive bias modification for interpretation (CBM-I) intervention could alter fatigue-related cognitive processing. Prior research suggests that individuals with high stress vulnerability tend to experience greater fatigue, potentially due to automatic negative interpretation patterns. However, the modifiability of such biases in the context of fatigue remains underexplored.

Thirty-five participants completed self-report measures of perceived stress and fatigue, as well as an interpretation bias task, at two time points: before and after a three-day CBM-I intervention. The intervention involved exposure to 30 ambiguous scenarios per session, which were designed to encourage more adaptive interpretations. Paired t-tests and linear mixed-effects models were used to assess change over time and to test whether perceived stress moderated these changes.

Consistent with previous findings, higher perceived stress was significantly associated with higher fatigue levels across time. However, neither interpretation bias nor fatigue showed significant changes following the intervention. Stress did not moderate these effects, and interpretation bias and fatigue were not significantly correlated at baseline.

These results indicate that the intervention dosage or measurement duration may have been insufficient to induce meaningful cognitive or symptomatic change. Additionally, the interpretation bias task was newly developed for this context and had not undergone prior validation for fatigue-related content, potentially limiting its sensitivity. Taken together, these findings reinforce the role of perceived stress in fatigue and highlight the need for future research to validate measurement tools and to explore longer, more intensive, or personalized interventions.

Introduction

Fatigue is considered to be a multifaceted condition. It is characterised by persistent exhaustion, reduced energy, and impairments in both cognitive and physical functioning (Fatt et al., 2019). While temporary fatigue is a normal response to effort or lack of sleep, chronic fatigue extends beyond usual tiredness. This can lead to significant disruptions in daily life. Chronic fatigue is associated with multiple significant health risks (Fatt et al., 2019; Sørengaard et al., 2019). These include reduced work productivity, increased likelihood of accidents, and heightened psychological distress. Decreased focus, memory problems, and slower information processing are common cognitive deficits reported by individuals that experience chronic fatigue (Hughes et al., 2017).

While prolonged fatigue can cause long-term disability in extreme cases, such as burnout or chronic fatigue syndrome, less severe but persistent fatigue can still significantly impair daily functioning and quality of life (Poppe et al., 2013). Autonomic dysfunction and elevated stress sensitivity worsen fatigue symptoms by contributing to emotional distress and reducing the capacity to manage daily stressors (Sørengaard et al., 2019).

Interpretation Bias and Cognitive Processing

Fatigue-related interpretation biases develop as individuals repeatedly encounter ambiguous bodily sensations or early warning signs that may or may not lead to fatigue (Hughes et al., 2017). These ambiguous internal cues differ from the actual subjective experience of fatigue but act as triggers for cognitive appraisals (Leung et al., 2022). Over time, a tendency to interpret these signals negatively can shape the subjective fatigue experience, reinforcing distress and maladaptive behaviours (Geraghty et al., 2019). Avoidant behaviours further maintain fatigue by limiting adaptive coping opportunities (Poppe et al., 2013).

Evidence from literature suggests that interpretation biases are prevalent among individuals experiencing chronic fatigue. For example, Sørengaard et al. (2019) found that

negative cognitive appraisals, including interpretation biases, were common in people reporting persistent fatigue symptoms. Similarly, Hughes et al. (2017) demonstrated that individuals with chronic fatigue syndrome exhibited heightened negative interpretations of ambiguous bodily sensations compared to healthy controls. These findings suggest that interpretation bias may be a key cognitive mechanism involved in fatigue.

Moreover, longitudinal studies indicate that such biases are not merely correlates but may play a causal and perpetuating role in fatigue. Sørengaard et al. (2019) showed that negative cognitive appraisals predicted fatigue severity over time, even after controlling for baseline symptom levels. This supports the idea that interpretation biases contribute to the maintenance and exacerbation of fatigue symptoms rather than being simple byproducts. Experimental work with Cognitive Bias Modification (CBM) techniques, though still emerging in fatigue research, also provides preliminary evidence that modifying interpretation biases can lead to improvements in fatigue-related outcomes (Leung et al., 2022). However, more research is needed to firmly establish causality and elucidate underlying mechanisms.

Theoretical Framework

Dual-process theories describe how both automatic and controlled cognitive processes influence emotional responses (Barlow et al., 2013). Neuroticism is characterized by increased emotional reactivity and a tendency to experience negative emotions. Individuals high in neuroticism often exhibit biased cognitive processing, such as heightened attention to threat-related information. Schneider (2004) found that neuroticism is associated with a habitual pattern of threat appraisal, where individuals are more likely to interpret ambiguous or neutral situations as threatening. This contributes to increased emotional distress.

Interpretation bias is defined as the tendency to negatively interpret ambiguous information. It has been widely implicated in anxiety and depression (Chen, Short, & Kemps, 2020). Furthermore, the inflexibility of interpretations, meaning the difficulty in changing the negative appraisals despite contradictory information, is another critical factor exacerbating

emotional disorders (Everaert et al., 2018). These cognitive-affective mechanisms suggest that biased and inflexible interpretation patterns contribute to the maintenance of fatigue and related distress.

This theoretical foundation supports the use of Cognitive Bias Modification for Interpretation (CBM-I), an intervention designed to retrain maladaptive interpretation patterns and reduce symptom severity. While CBM-I has demonstrated efficacy in anxiety and depression, initial evidence suggests potential applicability to fatigue-related conditions as well (Duizings et al., 2024).

Personality Traits

Personality traits may influence how individuals perceive and cope with fatigue, although the relationship is complex and multifactorial. Neuroticism is associated with emotional instability, heightened sensitivity to stress, and a tendency toward negative thinking (Barlow et al., 2013). Individuals high in stress vulnerability often struggle with emotional regulation and are more likely to interpret bodily sensations as distressing (Sørengaard et al., 2019). Moreover, those with high neuroticism are prone to appraising stressors as threatening, which exacerbates their emotional and physiological stress responses (Schneider, 2004).

This heightened threat appraisal mediates the relationship between neuroticism and increased negative affect. This contributes to greater vulnerability to fatigue. In this context, "negative affect" refers to the tendency to interpret ambiguous information pessimistically, leading to increased stress and emotional distress that exacerbate fatigue symptoms.

Interpretation bias is a specific form of threat appraisal (Chen, Short, & Kemps, 2020). It is characterised by the tendency to automatically and often unconsciously interpret ambiguous stimuli as threatening or negative. Thus, interpretation bias can be conceptualised as a key cognitive mechanism linking neuroticism with fatigue by shaping how individuals perceive bodily sensations and stressors. Research suggests that threat appraisals linked to neuroticism operate not only at an explicit, conscious level but also implicitly, outside of

conscious awareness (Barlow et al., 2013; Everaert et al., 2018). Individuals with high levels of neuroticism may exhibit automatic negative interpretations that contribute to ongoing emotional distress. These interpretations often occur without conscious deliberation and can reinforce maladaptive behaviors.

Maladaptive coping strategies, including avoidance behaviors, rigid all-or-nothing activity patterns, and excessive symptom focus, can maintain and worsen fatigue over time (Poppe et al., 2013). Although avoidance offers immediate relief, it reinforces fatigue by limiting exposure to adaptive coping experiences.

Cognitive Bias Modification for Interpretation (CBM-I)

Cognitive Bias Modification for Interpretation (CBM-I) is an intervention designed to target and modify automatic cognitive biases related to fatigue. It works by repeatedly exposing individuals to ambiguous fatigue-related scenarios and guiding them to adopt more neutral or positive interpretations (Leung et al., 2022).

Stress vulnerability, a facet of neuroticism, is associated with increased emotional reactivity and difficulties regulating responses to bodily sensations (Barlow et al., 2013). These psychological factors contribute to heightened distress and avoidance behaviors that may maintain fatigue symptoms (Poppe et al., 2013).

Unlike traditional cognitive-behavioral therapy (CBT), which relies on conscious self-monitoring and reflection, CBM-I operates at the automatic processing level. It gradually reshapes interpretation biases without requiring active effort. This approach shows promise for individuals with high stress vulnerability who tend to form negative implicit biases that reinforce fatigue.

Need of Study

While interpretation bias is known to contribute to persistent fatigue, most research on cognitive biases and their modification has focused on conditions like anxiety, depression, and chronic pain (Hughes et al., 2017). Evidence supporting CBM-I's efficacy in modifying

negative interpretation biases is promising across these populations (Duijzings, 2024, Leung et al., 2022). These interventions often use computer-based training tasks that encourage more positive or neutral interpretations of ambiguous stimuli. They are typically delivered in multiple short sessions over several weeks. Meta-analyses have reported moderate effect sizes for reducing negative interpretation biases and improving related symptoms. However, little is known about the effectiveness of CBM-I in addressing fatigue-related biases, particularly among individuals vulnerable to stress (Jones & Sharpe, 2017).

Stress vulnerability, as a core facet of neuroticism (Barlow et al., 2013), is associated with stronger emotional reactions and difficulties regulating responses to bodily sensations (Sørengaard et al., 2019). Negative interpretations in these individuals may perpetuate distress and avoidance behaviors, reinforcing fatigue cycles (Poppe et al., 2013). However, research directly exploring how stress vulnerability relates to fatigue-related interpretation biases and the potential for CBM-I to modify these biases remains limited.

This study will adapt ambiguous scenario tasks based on Hughes et al. (2017) to investigate whether CBM-I can shift interpretation biases in individuals with high vulnerability to stress, ultimately leading to improvements in self-reported fatigue. CBM-I involves presenting participants with ambiguous situations that can be interpreted positively or negatively and training them to consistently choose positive interpretations through repeated practice across multiple sessions.

Research Questions

RQ1:

Does interpretation bias towards fatigue change from pre- to post-intervention in a CBM-I training task?

RQ2:

Does self-reported fatigue change from pre- to post-intervention in a CBM-I training task?

RQ3:

Is stress vulnerability (i.e., neuroticism) associated with overall fatigue levels?

RQ4a:

Does stress vulnerability moderate the change in interpretation bias over time?

RQ4b:

Does stress vulnerability moderate the change in fatigue over time?

Methods

Participants

Participants were required to be at least 18 years old and proficient in English. Access to a smartphone or tablet was necessary, as the study utilised the Tiim application to deliver interventions and collect data. Ethical approval for the study was obtained from the Behavioural, Management, and Social-Science (BMS) Ethics Committee at the University of Twente.

Design and Procedure

This pilot study used an app-based data collection system developed by the BMS Lab at the University of Twente. Participants were recruited through the SONA system, Discord servers, and direct outreach by researchers.

After installing the Tiim app, participants gave informed consent, confirming their understanding of data anonymisation, storage, and their right to withdraw at any time. Those who declined consent exited the study without data being saved.

Following consent, participants completed a pre-training questionnaire collecting demographic information and baseline measures of fatigue, interpretation bias, neuroticism (specifically the vulnerability to stress facet), and locus of control. This took approximately 20–30 minutes.

The next day, participants engaged in multiple training tasks over several days, each session lasting 5–10 minutes. Notifications from the app reminded participants to complete daily tasks. No data was collected during the training itself.

Upon completing the final training session, participants completed a post-training questionnaire consisting of fatigue and interpretation bias measures, identical to those in the pre-training questionnaire.

Materials

Tiim Application

The Tiim app, developed by the BMS Lab, is an e-health intervention platform that facilitates streamlined study delivery via mobile devices. It supports timed questionnaire releases and secure data collection, having been validated in over 350 prior studies.

Fatigue Measure

Fatigue was assessed pre- and post-training using the Chalder Fatigue Scale (CFQ-11), an 11-item self-report questionnaire measuring physical and mental fatigue experienced over the past two weeks. Each item is rated on a 4-point Likert scale ranging from 0 ("less than usual") to 3 ("much more than usual"), with higher total scores indicating greater fatigue. An example item is, "Do you feel tired?" (Fong et al., 2015). The CFQ-11 has demonstrated good psychometric properties, with Cronbach's alpha values ranging from .86 to .90 in various samples (Fong et al., 2015).

Interpretation Bias Measure

Interpretation bias was assessed using a self-developed ambiguous scenarios task adapted from Hughes et al. (2017). The task consisted of 20 short, ambiguous scenarios centered around fatigue and everyday life situations. Each scenario was followed by four response options: a positive interpretation, a negative interpretation, a positive foil, and a negative foil. Participants were instructed to select the interpretation they found most plausible.

For example:

"You're faced with a challenging task at work and you feel physically exhausted. You think…"
a) *"I've handled tough tasks before, and I'll get through this one too." (Positive interpretation)*

b) *"I can't handle this; I'm just too tired to focus." (Negative interpretation)*

c) *"I'll tackle it step by step, and my exhaustion will fade once I get going." (Positive foil)*

d) *"I'm never able to do this when I'm tired; it's just too much." (Negative foil)*

"You've had a long day at work, and you're feeling mentally and physically drained. You think…"
a) *"Taking a break will help me recharge, and I'll feel better afterward." (Positive interpretation)*

b) *"I can't relax; I'm just too tired and will fall asleep." (Negative interpretation)*

c) *"A short break will be refreshing; it's not too hard to relax, even when I'm tired." (Positive foil)*

d) *"I never feel refreshed after a break when I'm this drained; it's pointless." (Negative foil)*

This task was designed to implicitly measure cognitive biases without explicitly prompting participants about their biases. It was administered before and after the CBM-I training to assess changes in interpretation bias. The task's design aligns with CBM-I principles, as the training aims to shift participants' automatic interpretations toward more positive or neutral appraisals. While this specific task is novel, it is grounded in established methodology from Hughes et al. (2017), which demonstrated acceptable reliability and sensitivity to change. The interpretation bias score was calculated by first finding the average number of neutral interpretations chosen and the average number of fatigue-related (negative) interpretations chosen across all scenarios. The bias score was then computed by subtracting the average fatigue-related interpretation score from the average neutral interpretation score.

A higher positive value indicates a greater tendency to select neutral over fatigue-related interpretations, reflecting a more positive interpretation bias.

Personality Measures

Stress Vulnerability

Stress vulnerability was assessed using six items from the Vulnerability to Stress facet of the NEO Five-Factor Inventory (McCrae & Costa, 2005). Participants rated each item on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"), with higher scores indicating greater sensitivity to stress and emotional instability. The total score was calculated as the mean of the six items. It is important to note that the full neuroticism domain was not measured; therefore, references to "neuroticism" in this thesis refer specifically to this stress vulnerability facet.

The NEO-FFI has demonstrated good psychometric properties across various populations. The Neuroticism domain includes the Vulnerability to Stress facet and typically shows high internal consistency, with Cronbach's alpha values between .83 and .88 (McCrae, Costa, & Martin, 2005). Factor analytic studies report strong loadings of the Vulnerability to Stress items on the Neuroticism factor, generally above .50, supporting construct validity. Furthermore, the Vulnerability to Stress facet shows good convergent validity, correlating positively with other measures of emotional instability and stress sensitivity, with correlations typically ranging from .60 to .80 (McCrae, Costa, & Martin, 2005). While McCrae, Costa, and Martin (2005) noted that some individual items within the Neuroticism domain showed weaker item-total correlations, the overall scale reliability remains acceptable and thus supports its continued use for assessing stress vulnerability in research settings.

Data Analysis

All statistical analyses were performed using R version 4.2.1 (2022-06-23 ucrt), nicknamed *"Funny-Looking Kid"*. Data preparation and transformation were conducted using

the tidyverse package, and linear mixed-effects models were implemented using the lme4 package.

Fatigue and interpretation bias scores collected at pre- and post-intervention time points were reshaped into long format to reflect the repeated-measures design. This format enabled the use of linear mixed-effects models (LME), which account for within-subject correlations over time.

Each model included time (coded as 0 = pre-training, 1 = post-training), stress vulnerability (mean-centered neuroticism scores), and their interaction as fixed effects. This modeling approach allowed for the examination of both main effects and moderation—specifically, whether changes over time varied as a function of individual differences in stress vulnerability. Participant ID was included as a random intercept to account for between-subject variability.

Model assumptions, including normality of residuals, homogeneity of variance, and multicollinearity, were assessed using tools from the performance and parameters packages. No serious violations were detected. Full diagnostic plots and assumption checks are provided in Appendix A and visually summarized in Figure 2 (Appendix).

Results

Descriptive Statistics

Descriptive statistics for the main study variables are presented in Table 1. The sample included 35 participants after data cleaning and omission of missing values. Stress scores ranged from 1.00 to 4.33 (M = 2.83, SD = 0.89). Interpretation bias scores were measured at two time points ("intro" and "outro"), with means of 2.47 (SD = 0.18) and 2.50 (SD = 0.19), respectively. Fatigue scores showed mean values of 1.18 (SD = 0.22) at intro and 1.13 (SD = 0.22) at outro.

To address Research Question 2, we examined whether stress vulnerability was associated with fatigue levels at baseline.

A Pearson correlation showed a significant positive association between stress and fatigue at the intro measurement (r = .48, p = .004), suggesting that participants with higher stress scores also reported higher levels of fatigue at baseline.

Table 1

Descriptive Statistics for Key Study Variables (N = 35)

	Mean	**SD**	**Min.**	**Median**	**Max.**
Stress Score	2.79	0.89	1.00	2.83	4.33
Interpretation Bias Intro	2.47	0.18	2.00	2.43	2.93
Interpretation Bias Outro	2.50	0.19	2.10	2.48	3.05
Fatigue Intro	1.18	0.22	0.69	1.19	1.69
Fatigue Outro	1.13	0.22	0.81	1.13	1.81
Interpretation Bias Gain	0.03	0.18	-0.45	-0.03	0.55
Fatigue Gain	-0.05	0.17	-0.63	0.00	0.56

Note. N = 35 after excluding missing data. Scores represent mean values and standard deviations calculated from participants' responses.

- *Stress Score:* Assessed via neuroticism subscale, indicating levels of perceived stress (range 1–5).

- *Interpretation Bias Intro & Outro:* Scores indicating interpretation bias measured at the start (intro) and end (outro) of the training.

- *Fatigue Intro & Outro:* Self-reported fatigue levels measured at the start and end of the training.

- *Interpretation Bias Gain:* Change in interpretation bias score from intro to outro (outro minus intro). Positive values indicate increased bias over time.

- *Fatigue Gain:* Change in fatigue score from intro to outro. Negative values indicate a reduction in fatigue over time.

Raw scores are not available, these values are processed scores used in analysis.

Paired t-Test Analyses

To address Research Question 1, it was tested whether interpretation bias changed from pre- to post-intervention. Paired t-tests were conducted to examine changes in interpretation bias and fatigue from pre- to post-training. As shown in Table 3, no significant differences were observed for interpretation bias. To address Research Question 2, we tested whether self-reported fatigue changed from pre- to post-intervention.

A paired-samples t-test showed no significant change in fatigue scores. No significant changes were observed, suggesting that the CBM-I intervention did not have a measurable impact on either outcome over the training period.

Two linear mixed-effects models were then tested to assess the effects of stress vulnerability and time on fatigue. The first model included stress and time as fixed effects, while the second model added the interaction between stress and time as a moderator. Stress was a significant predictor of overall fatigue levels ($\beta = 0.144$), indicating that participants with higher stress reported increased fatigue. However, neither time nor the interaction between stress and time were significant, suggesting that stress did not moderate changes in fatigue across the training period.For interpretation bias, neither stress, time, nor their interaction significantly predicted scores, indicating that interpretation bias remained stable over time and was unaffected by stress levels (see Table 2).

Table 2

Paired t-Test and Linear Mixed-Effects Model Results for Fatigue and Interpretation Bias

	Estimate (β)	Std. Error	t value	95% Confidence Interval Lower	95% Confidence Interval Upper
Paired t-Test Results					

	Estimate	SE	t	Lower	Upper
Interpretation Bias Intro vs Outro	-0.028		-0.71	-0.11	0.05
Fatigue Intro vs Outro	0.046		1.32	-0.02	0.12
Fatigue Model 1 (Stress + Time)					
Intercept	0.779	0.100	7.808	0.585	0.972
Stress Score	0.144	0.034	4.227	0.078	0.211
Time (Outro)	-0.022	0.115	-0.191	-0.245	0.202
Fatigue Model 2 (Stress + Time + Interaction)					
Intercept	0.779	0.100	7.808	0.585	0.972
Stress Score	0.144	0.034	4.227	0.078	0.211
Time (Outro)	-0.022	0.115	-0.191	-0.245	0.202
Stress Score × Time	-0.011	0.039	-0.287	-0.087	0.064
Interpretation Bias Model (Stress + Time + Interaction)					
Intercept	2.397	0.112	21.328	2.179	2.615
Stress Score	0.018	0.039	0.466	-0.057	0.093
Time (Outro)	-0.002	0.128	-0.017	-0.250	0.254
Stress Score × Time	0.015	0.043	0.343	-0.071	0.099

Linear Mixed-Effects Models

To address Research Question 3, we tested whether stress vulnerability moderated the effect of CBM-I on fatigue and interpretation bias outcomes by including the interaction between stress and time in linear mixed-effects models. Linear mixed-effects models (LMM) using the lmer function assessed the effects of stress vulnerability, time (intro vs. outro), and

their interaction on fatigue and interpretation bias. Participant ID was modelled as a random intercept to account for repeated measures.

To address Research Question 4a, it was tested whether stress vulnerability moderated changes in interpretation bias over time. The interaction between stress and time was not significant ($\beta = 0.015$, SE = 0.043, t = 0.34, p = .74), indicating that stress vulnerability did not influence changes in interpretation bias during the intervention period.

For Research Question 4b, it was examined whether stress vulnerability moderated changes in fatigue. The interaction term between stress and time was also non-significant ($\beta = -0.011$, SE = 0.039, t = –0.29, p = .77), suggesting that stress vulnerability did not affect fatigue changes over time.

Fatigue

The fatigue linear mixed-effects model (LME) showed acceptable fit, REML = –24.7, AIC = 58.7, BIC = 66.1, marginal R^2 = .22, conditional R^2 = .39. The model revealed a significant positive effect of stress score ($\beta = 0.144$, SE = 0.034, t = 4.23), indicating that participants with higher stress levels reported greater fatigue overall. Neither the main effect of time ($\beta = -0.022$, SE = 0.115, t = –0.19) nor the interaction between stress and time ($\beta = -0.011$, SE = 0.039, t = –0.29) reached significance. These findings suggest that fatigue levels did not change significantly over time and that stress did not moderate this pattern.
This supports Research Question 3, confirming that stress vulnerability significantly predicts fatigue severity. The non-significant interaction further addresses Research Question 4b, indicating that stress vulnerability did not moderate changes in fatigue over time.

Interpretation Bias

The interpretation bias model also showed adequate fit, REML = –6.4, AIC = 84.2, BIC = 91.6, marginal R^2 = .02, conditional R^2 = .43. None of the predictors reached statistical significance: stress ($\beta = 0.018$, SE = 0.039, t = 0.47), time ($\beta = -0.002$, SE = 0.128, t = –0.02),

or their interaction (β = 0.015, SE = 0.043, t = 0.34). Thus, interpretation bias scores remained

stable over time and were unaffected by stress vulnerability, indicating no moderation effect.

Table 3

Fixed Effects Estimates and 95% Confidence Intervals for Linear Mixed-Effects Model

Predicting Fatigue (N = 35)

	Estimate	**SE**	**t value**	**95% CI Lower**	**95% CI Upper**
(Intercept)	0.779	0.100	7.808	0.585	0.972
Stress Score	0.144	0.034	4.227	0.078	0.211
Time (fat_out)	-0.022	0.115	-0.191	-0.245	0.202
Stress Score × Time	-0.011	0.039	-0.287	-0.087	0.064

Time coded as intro (reference) vs. outro.

To address Research Question 1, it was examined whether stress vulnerability was

associated with interpretation bias across the study period. The linear mixed-effects model did

not reveal significant effects of stress on interpretation bias scores. There were no significant

main effects of stress ($p = .641$), time ($p = .987$), or their interaction ($p = .733$). This indicates

that participants' interpretation bias remained stable over time and was not influenced by their

level of stress vulnerability. While the model fit was adequate, the results suggest that

interpretation bias was unaffected by the variables tested in this analysis.

Table 4

Fixed Effects Estimates and 95% Confidence Intervals for Linear Mixed-Effects Model

Predicting Interpretation Bias (N = 35)

	Estimate	SE	t value	95% CI Lower	95% CI Upper
(Intercept)	2.397	0.112	21.328	2.179	2.615
Stress Score	0.018	0.038	0.466	-0.057	0.093
Time (ib_bias_out)	-0.002	0.128	-0.017	-0.250	0.254
Stress Score × Time	0.015	0.043	0.343	-0.071	0.099

Discussion

The aim of this study was to explore whether cognitive interpretation bias and self-reported fatigue would change over time in response to a Cognitive Bias Modification for Interpretation (CBM-I) procedure, and whether these changes were moderated by individual differences in stress vulnerability. This study examined whether interpretation bias and fatigue changed from pre- to post-assessment. Furthermore, it was assessed whether stress vulnerability predicted overall levels of these variables and whether stress vulnerability moderated their changes over time.

Consistent with prior research, higher stress scores were significantly associated with higher levels of fatigue across the measurement period. This supports the notion that individuals with higher stress vulnerability tend to report greater fatigue. However, no significant main effects of time were found for either fatigue or interpretation bias. This suggests that these variables did not substantially change between the pre- and post-assessment phases. Furthermore, no interaction effects between stress vulnerability and time were observed for either interpretation bias or fatigue, which indicates that stress did not

moderate changes in these outcomes over the intervention period. This lack of moderation further suggests that the CBM-I intervention was not effective in altering fatigue or interpretation bias. However, the persistently elevated fatigue observed in individuals with higher stress vulnerability likely reflects enduring personality traits rather than transient state factors.

Stress vulnerability is often described as a dispositional tendency toward heightened emotional reactivity and difficulty regulating distress. This aligns closely with the construct of neuroticism (Barlow et al., 2013). People with this trait tend to get stuck in repeated negative thoughts like worry and rumination, where they focus over and over on their distress and what might be causing it (Du et al., 2018). This creates an ongoing mental and emotional strain that can lead to fatigue, even when there are no immediate external stressors.

Furthermore, longitudinal findings demonstrate that neuroticism predicts fatigue both cross-sectionally and after extended follow-up periods. Sørengaard et al. (2019), for example, found that individuals high in neuroticism were more likely to report persistent or emerging fatigue symptoms over time. This indicates a trait-based pathway through which stress vulnerability contributes to the persistence of fatigue symptoms. The absence of significant changes in interpretation bias and fatigue suggests that modifying deeply ingrained automatic cognitive biases may require more intensive or prolonged training. However, baseline interpretation bias in this sample was modest (M = 0.27, SD = 0.48), which indicates that participants did not show particularly strong negative biases at the outset, which could limit the potential impact of a targeted CBM-I intervention.

Cognitive biases are sustained by ingrained neurocognitive patterns, and meaningful change typically requires frequent and repeated practice. Meta-analyses support the importance of increased training frequency for improving CBM-I outcomes. For instance, Jones and Sharpe (2017) demonstrated that session quantity and timing influence effectiveness, especially in clinical populations such as those with social anxiety, depression,

or chronic pain. In the current study, participants completed three CBM-I sessions, each consisting of 30 ambiguous scenarios, administered once daily over three consecutive days. It is possible that this dosage was insufficient to produce measurable effects.

Additionally, the sample showed modest baseline interpretation bias (M = 0.27, SD = 0.48), indicating participants did not exhibit strong negative biases initially. This limited symptom severity could reduce the potential for the CBM-I intervention to demonstrate measurable effects. Furthermore, no post hoc analyses were conducted to explore potential subgroup differences or task-specific effects, which restricts interpretive confidence and may have hidden meaningful patterns in the data.

Other alternative explanations for the lack of intervention effects include a follow-up period that was too short to detect changes in fatigue, and the use of an interpretation bias task that may lack adequate validity or sensitivity for fatigue-related content. Finally, it remains possible that interpretation bias is not a central mechanism underlying fatigue in this population. Supporting this, baseline interpretation bias and fatigue were not significantly correlated ($r = .07$, $p = .66$), suggesting these constructs may operate independently in this sample.

Several methodological issues may have influenced the weak interpretation bias findings. At baseline, the interpretation bias measure showed a modest mean score (M = 0.27, SD = 0.48), and interpretation bias was not significantly correlated with fatigue ($r = .07$, $p = .66$), indicating a weak and non-significant association between the two constructs.

First, the CBM-I scenarios used were newly developed for this study and have not yet undergone specific validation for fatigue-related content, raising concerns about their construct validity and sensitivity. Second, the study did not conduct post hoc analyses, such as examining subgroup differences or task-specific effects, which limits confidence in the generalizability and interpretability of the results. Third, reliance on self-report measures introduces risks of response biases, such as social desirability and inaccuracies in subjective

reporting. These factors collectively raise questions about the reliability of the observed bias effects and may have contributed to the lack of measurable change following the intervention. While the lack of prior validation is a significant limitation, further psychometric testing is necessary to determine how much this affected the outcomes.

As suggested by the findings, interpretation bias may not be the sole or central cognitive mechanism underlying fatigue in this population. This possibility aligns with the results from Research Question 3, which indicate that other factors, such as stress vulnerability, may play a more significant role. However, caution is warranted in drawing firm conclusions, given the concerns about the validity of the interpretation bias task (IBT) and the unclear effectiveness of the CBM-I intervention in modifying interpretation bias. Within dual-process theories, human cognition operates on two levels: a fast, automatic, emotionally reactive system, and a slower, deliberate, reflective system (Barlow et al., 2013). Individuals high in neuroticism tend to rely more heavily on automatic processing, which manifests as biased attention, threat appraisals, and inflexible interpretation patterns. These automatic processes occur outside conscious awareness and may be especially resistant to change without sufficient cognitive control or emotional regulation. In this study, interpretation bias was understood as a type of automatic processing, placing it within the wider context of cognitive-affective models.

The lack of significant reduction in fatigue suggests that interpretation bias may not be the dominant cognitive factor contributing to fatigue symptoms in this group. Other automatic processes, such as persistent worry, attentional bias, or rumination, could have a greater impact by sustaining continuous cognitive activation. Additionally, participants may have lacked adequate top-down regulation, which refers to the conscious, deliberate control needed to override or adjust habitual automatic thoughts. Without sufficient top-down control, deeply ingrained cognitive patterns can be difficult to change. Emotional distress linked to neuroticism likely involves a wider cognitive-affective network beyond interpretation bias

alone. Given the limited scope of the CBM-I intervention applied here, focusing on a single mechanism may not have been enough to modify the complex cognitive-emotional processes that sustain fatigue.

This study offers several strengths. Conducting the intervention via a mobile app provided a scalable and accessible platform. Additionally, the study's focus on individuals with varying levels of stress vulnerability provides insight into the relevance of cognitive bias modification approaches for stress-related fatigue.

A major limitation of this study concerns the measurement of interpretation bias. The interpretation bias task (IBT) employed was developed specifically for this project by adapting items originally designed for anxiety research. Although the scenarios were modified to reflect fatigue-relevant content, the task has not yet undergone formal psychometric validation within fatigue populations. This raises concerns regarding the construct validity of the measure and its ability to accurately capture interpretation biases pertinent to fatigue symptoms.

Several potential shortcomings of the IBT may have impacted its effectiveness. Some scenarios may have lacked sufficient relevance for the sample, which potentially limited participant engagement and ecological validity. Furthermore, the ambiguity of the scenarios may have been inadequate, reducing the task's sensitivity. Additionally, the reliance on recall-based responses introduces the possibility of memory-related biases and response errors. These factors may have compromised the reliability and validity of the IBT

Both fatigue and interpretation bias were assessed via self-report measures. These are subject to response biases such as social desirability and inaccuracies in individuals' subjective evaluation of their internal states (Caputo, 2017). These methodological limitations constrain the interpretability and generalizability of the findings.

Future research should prioritize the development and formal validation of interpretation bias tasks tailored specifically for fatigue populations to enhance construct

validity. Incorporating multi-method approaches, including behavioral and physiological assessments alongside self-report, could further strengthen the reliability and interpretability of results in this domain.

Other limitations include inconsistent adherence due to flexible intervention scheduling. Although reminders were sent, sessions were sometimes completed with gaps of several days. Regular and spaced practice is important for modifying cognitive biases. Meta-analyses suggest that more training sessions improve cognitive bias modification effectiveness (Jones & Sharpe, 2017). Furthermore, the intervention materials may not have been optimally designed to shift fatigue-related interpretation biases. The interpretation bias task used in this study was initially based on generic materials adapted from cognitive bias modification developed for anxiety disorders (Hughes et al., 2017). Early in the development process, it became apparent that many scenarios lacked clear relevance to fatigue-specific concerns. In response, several items were modified or rewritten, incorporating themes such as energy levels, task avoidance, and social withdrawal. Despite these adaptations, the task remains newly developed and has not yet undergone any formal validation. This raises important considerations regarding the construct validity and ecological relevance of the CBM-I training scenarios, which may have limited the intervention's effectiveness in modifying interpretation bias.

The clear link between stress vulnerability and fatigue reveals the need for fatigue treatments to specifically target stress-related factors. While the CBM-I app did not prove effective here, it offers valuable insights for clinicians and app developers. Effective app-based CBM-I requires well-designed tasks and features that encourage regular use and user engagement. Cognitive bias training should be combined with stress management and behavioural approaches to better address fatigue. Reliable, user-friendly digital platforms are essential for maintaining motivation.

In conclusion, the results show that stress vulnerability plays a significant role in fatigue; however, the CBM-I intervention did not produce meaningful changes in interpretation bias or fatigue. This highlights the need for longer or more focused interventions and improved measurement and intervention tools. Future studies should develop methods that more effectively address the cognitive and emotional factors involved in persistent fatigue, as well as improve the reliability of intervention delivery through better technology, given the technical issues experienced with the app in this study.

References

Barlow, D. H., Sauer-Zavala, S., Carl, J. R., Bullis, J. R., & Ellard, K. K. (2014). The nature, diagnosis, and treatment of neuroticism: Back to the future. *Clinical Psychological Science, 2*(3), 344–365. https://doi.org/10.1177/2167702613505532

Brosschot, J. F., Gerin, W., & Thayer, J. F. (2006). The perseverative cognition hypothesis: A review of worry, prolonged stress-related physiological activation, and health. *Journal of Psychosomatic Research, 60*(2), 113–124. https://doi.org/10.1016/j.jpsychores.2005.06.074

Caputo, A. (2017). Social desirability bias in self-reported well-being measures: Evidence from an online survey. *Universitas Psychologica, 16*(2), 1–13. https://doi.org/10.11144/Javeriana.upsy16-2.sdsw

Chen, J., Short, M., & Kemps, E. (2020). Interpretation bias in social anxiety: A systematic review and meta-analysis. *Journal of Affective Disorders, 276*, 1119–1130. https://doi.org/10.1016/j.jad.2020.07.121

Du, J., Huang, J., An, Y., & Xu, W. (2018). The relationship between stress and negative emotion: The mediating role of rumination. *Clinical Research and Trials, 4*(1), 1–5. https://doi.org/10.15761/CRT.1000208

Duijzings, M., Todd, J., & Notebaert, L. (2024). A randomized controlled trial modifying insomnia-consistent interpretation bias in students. *Behaviour Research and Therapy, 171*, 104607. https://doi.org/10.1016/j.brat.2024.104607

Eisenlohr-Moul, T. A., Rubinow, D. R., Schiller, C. E., Girdler, S. S., & Segerstrom, S. C. (2018). The relationship between psychological stress and cortisol response: A meta-

analytic review. *Neuropsychopharmacology, 43*(2), 432–442. https://doi.org/10.1038/s41386-018-0206-6

Fatt, S. J., Cvejic, E., Lloyd, A. R., Vollmer-Conna, U., & Beilharz, J. E. (2019). The invisible burden of chronic fatigue in the community: A narrative review. *Current Rheumatology Reports, 21*(2), 5. https://doi.org/10.1007/s11926-019-0804-2

Geraghty, K. J., Hann, M., & Kurtev, S. (2019). The cognitive behavioural model of chronic fatigue syndrome: A critique of a flawed model. *Health Psychology Open, 6*(1), 1–9. https://doi.org/10.1177/2055102919838907

Hughes, A. M., & Ross-Morris, J. (2017). Attentional and interpretation bias in chronic fatigue syndrome. *Psychology & Health, 32*(3), 300–316. https://doi.org/10.1080/08870446.2016.1260725

Leung, C. J., Yiend, J., Trotta, A., & Lee, T. M. C. (2022). The combined cognitive bias hypothesis in anxiety: A systematic review and meta-analysis. *Journal of Anxiety Disorders, 89*, 102575. https://doi.org/10.1016/j.janxdis.2022.102575

Li, H., Huan, L., Zhang, Z., Zhao, M., Song, S., Huang, X., ... & Zhang, Y. (2017). Particulate matter exposure and stress hormone levels: A randomized, double-blind, crossover trial of air purification. *Circulation, 136*(5), 618–627. https://doi.org/10.1161/CIRCULATIONAHA.117.027654

McCrae, R. R., Costa, P. T., Jr., & Martin, T. A. (2005). The NEO-PI-3: A more readable revised NEO personality inventory. *Personality and Individual Differences, 40*(3), 213–224. https://doi.org/10.1016/S0191-8869(03)00118-1

Poppe, C., Petrovic, M., Vogelaers, D., & Crombez, G. (2013). Cognitive behavior therapy in patients with chronic fatigue syndrome: The role of illness acceptance and

neuroticism. *Journal of Psychosomatic Research, 74*(5), 367–372.

https://doi.org/10.1016/j.jpsychores.2013.02.011

Schacter, D. L. (1992). Understanding implicit memory: A cognitive neuroscience

approach. *American Psychologist, 47*(4), 559–569. https://doi.org/10.1037/0003-

066X.47.4.559

Schneider, T. R. (2004). The role of neuroticism in stress-vulnerability and stress-

appraisal: A quantitative review. *Stress and Health, 20*(3), 169–182.

https://doi.org/10.1002/smi.1020

Sørengaard, T. A., Saksvik-Lehouillier, I., & Langvik, E. (2019). Longitudinal and

cross-sectional examination of the relationship between personality and fatigue among shift

workers. *Cogent Psychology, 6*(1). https://doi.org/10.1080/23311908.2019.1574095

Appendix

Figure 2
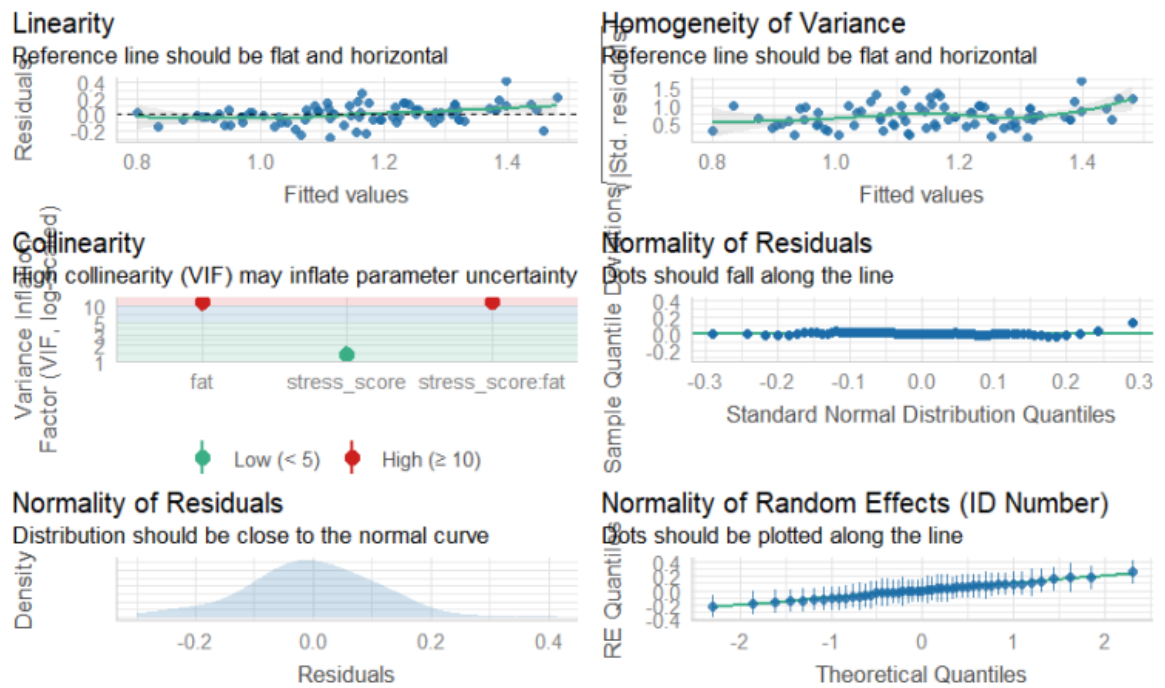
Model Diagnostics

Model diagnostics showed no severe violations of assumptions. Residuals were approximately normally distributed with homogenous variance. However, variance inflation factors indicated some multicollinearity among predictors, suggesting interpretations should be cautious.

CBM-I Training Tasks

Day 1

An important deadline is coming up, and you decide to spend a day completing some of the bigger parts of the project. Afterwards, you feel…

Proud

Did you feel proud after completing some of the bigger parts of the project?

On holiday, you decide to visit a local museum. You spend hours walking around, marveling at the different displays. When you finally get home in the evening, you feel…

Fulfilled

Did you feel fulfilled after walking through the local museum?

You decide to start going to the gym consistently 3 times a week. After the first week, you feel soreness in your leg muscles. This is because you are getting…

Stronger

Are you gettting stronger because you have been going to the gym consistently?

You're feeling a bit tired while studying or working. You push through and realize that you are…

Motivated

You realize you made a small error at work or school. You spend extra time correcting it and feel…

Responsible

You've been out doing errands for hours. As you return home, you feel…

Satisfied

Did you feel satisfied after running errands for hours?

You need to talk to someone about something important. Your heart starts beating fast, you think this is because you are...

Nervous

You've had a long, demanding week at work or school. On Friday evening, you reflect and feel…

Proud

Did you feel proud after the long demanding week at school or work?

After spending some time tidying up your room, you look around and feel…

Refreshed

Did you feel refreshed after tidying up your room?

You spend a long time preparing a homemade meal for yourself or others. As you sit down to eat, you feel…

Accomplished

Did you feel accomplished after preparing a homemade meal for yourself?

You take a few minutes to tidy up your kitchen. As you finish, you step back and notice that you feel…

Proud

Did you feel proud after tidying up your kitchen?

You spend an hour folding a large pile of laundry. After looking at the neatly stacked clothes, you feel…

Satisfied

After putting in days of effort, you finally complete a long-term project. You step back and feel a sense of…

Accomplishment

A friend or colleague asks for your help with something they're struggling with. After spending a while helping them, you feel…

Useful

You had a long day filled with various activities. In the evening, you sit down and reflect on your day. You realize that despite feeling physically tired, you have been quite…

Productive

You are running behind schedule for an important appointment. Instead of panicking, you take a deep breath and remain…

Collected

Did you feel collected after you took a deep breath instead of panicking?

After dinner, you take a moment to wash the dishes. As you finish, you step back and notice that you are…

Satisfied

You are faced with a challenging task that requires effort and patience. After working through it step by step, you realize you are…

Resilient

You decide to try a new hobby or skill, even though you're not sure how well you'll do. As you put time and effort in, you notice that you are…

Learning

You are tasked with presenting something at work or in class. Although you feel nervous at first, once you start speaking, you feel…

Confident

Did you feel confident after presenting something in front of your class or at work?

You are enjoying a picnic when unexpected rain begins to fall. You move quickly to avoid the rain. After finding a spot to rest you notice you are…

Soaked

Something unexpected comes up in your day. At first, you feel unsure, but then you realize you are…

Capable

You wake up after a night of sleep. You take a deep breath and notice that you feel…

Refreshed

Did you feel refreshed after waking up after a night of sleep?

You attend a gathering where you don't know everyone. As you talk to different people, you notice that you are getting…

Compliments

 You have a task that requires focus and effort. After getting started, you are feeling…

Competent

You go for a walk even though you weren't sure if you had the energy. Afterward, you feel a sense of…

Achievement

Did you feel a sense of achievement after going for a walk?

You go grocery shopping and carry your bags home. At the end of the trip, you are feeling…

Capable

A friend asks you to meet up after work or class. You are unsure if you have the energy but decide to go. As the conversation flows, you realize you are feeling quite…

Engaged

Did you feel engaged after meeting with your friend?

Yesterday, you went for a walk with a friend. This morning, you notice your legs are stiff. You think today will be…

Chill

Normally, you go to the gym on Tuesday mornings, but you decide to skip it today because you were too?

Preoccupied

Day 2

You've been putting in extra effort to learn a new skill. After some practice, you realize you are…

Progressing

Are you progressing after putting in extra effort to learn a new skill?

You face a tough challenge at work, but after some effort, you overcome it, leaving you feeling…

Empowered

Did you feel empowered after overcoming a tough challenge at work?

You finish a large home improvement project that took time and effort. You finally sit down and feel…

Proud

You encounter a problem and work through it until you find a solution. You feel…

Resourceful

You're faced with unexpected changes, but you quickly adapt to the issue, leaving you feeling…

Flexible

You're in a distracting environment, and you put a lot of effort into staying focused on your work. You feel…

Determined

Did you feel determined after staying focused in a distracting environment?

You assist a stranger in need, and after doing so, you feel…

Fulfilled

You face a setback in your goals, but you put in extra effort to work toward them and feel…

Resilient

You spend some time explaining a concept to someone, and they finally understand it. You feel…

Satisfied

You realize you made a mistake and take responsibility for it. After spending extra time fixing the mistake, you feel…

accountable

You've been taking steps to improve your self-esteem, and today you feel…

Confident

Did you feel confident after taking steps to improve your self-esteem?

You've been consistently working out, and you feel good about the progress you've made. You start to feel…

Energized

Did you feel energized after consistently working out?

Leading up to an important deadline, you've been spending more time working than usual. You notice you start to get sleepy sooner than normal. This is probably due to…

Work

You are juggling multiple tasks at once. Despite the pressure, you manage to stay focused and feel…

Efficient

Did you feel efficient after managing to juggle multiple tasks at once?

A friend goes through a tough time, and you offer your support. After a long conversation with them, you feel…

Helpful

You're running a bit late for your bus. You decide to run, and you catch the bus right before it leaves. You sit down and feel…

Relieved

Did you feel relieved after making it to the bus right before it left?

An unexpected situation arises that could cause panic. You feel…

Collected

You've been sticking to a healthy routine, even though it's been challenging. At the end of the week, you feel…

Accomplished

Did you feel accomplished after sticking to a healthy routine even though it was challenging?

A colleague or friend asks you for help with a personal issue. You offer your assistance and feel…

Compassionate

You face a situation that makes you anxious, but you push through it and feel…

Brave

Did you feel brave after pushing through a situation that made you feel anxious?

You have a project due soon and need to complete it quickly. Despite the pressure, you are organized and feel…

Calm

You've had a long, demanding week at work or school. On Friday evening, you reflect and feel a sense of…

Accomplishment

You are meeting up with an old school friend. You ask them if they would meet you locally. They will think you are...

Busy

You have been invited to a wedding this weekend. It's not close to home, so you would have to travel by car and stay overnight at a hotel nearby. You think the weekend will be...

Enjoyable

You have had a busy day at work and have a number of tasks to get done before the end of the day. You ask a colleague for help because you are...

Busy

Today, you spent a long time grocery shopping and bought ingredients for dinner. When you get home, you are...

Hungry

You've been out doing errands for hours. As you return home, you feel…

Satisfied

You prepare a homemade meal for yourself or others. As you sit down to eat, you feel…

Proud

On holiday, you decide to visit a local museum. You spend hours walking around, marvelling at the different displays. When you finally get home in the evening, you feel...

Fulfilled

Normally, you go to the gym on Tuesday mornings, but you decide to skip it today because you were too...

Busy

Day 3

After a stressful week, you and your friend are making plans, and they pitch an idea of spending a day hiking a local trail. You find that idea...

Fun

One day, you finally decide to fix the annoying squeaking your bedroom door is making. You spend a couple of hours figuring out what's causing the problem. You get the tools out and fix it yourself. Afterwards, you feel...

Satisfied

Did you feel satisfied after you spend a couple of hours fixing the annoying squeaking bathroom door?

You had an exhausting day at work. For lunch, you decide to go to a local food truck for a change. You stand in line for 20 minutes waiting to get your food. Once you get your food and sit down, you feel...

Excited

Normally, you go to the gym on Tuesday mornings, but today you are really tired. You still go to the gym, afterwards you feel…

Refreshed

Did you feel refreshed after you went to the gym although you were tired?

During a particularly busy day at work, you decide to take a walk during your break. When you get back from your walk, you feel...

Refreshed

You decide to start going on walks consistently 3 times a week. After the first week, you feel soreness in your leg muscles. This is because you are getting...

Stronger

Are you getting stronger because your legs are feeling sore after going on walks for a week?

After getting back from grocery shopping, you are exhausted. You realize that you forgot something essential and need to go back. After getting it, you are now…

Happy

You spent the whole day working on an important assignment, and you finally get home and eat. After washing up and sitting down at the end of the day, your body feels...

Relaxed

You overslept and are running a bit late for your bus. You decide to run and catch the bus right before it leaves. You sit down and feel…

Relieved

You go for a walk even though you weren't sure if you had the energy. Afterward, you feel a sense of…

Pride

Did you feel a sense of pride after going on a walk although you were not sure if you had the energy?

You are faced with a challenging task. After working through it step by step, you realize you are…

Patient

Do you feel patient after you managed to work through a difficult task step by step?

During a stressful and tiring workday, a colleague asks for your help with something they're struggling with. As you assist them, you feel…

Helpful

You are running late for an appointment and have taken public transport to get there. You arrive at your station to find the lifts and escalators are out of order. Passengers have been advised to either get off at the next stop for disabled access or use the stairs. You think if you take the stairs you will probably be...

Fine

You've had a very busy day at work and now its time for lunch break. After eating, you feel…

Energized

Did you feel energized after eating lunch during this busy day at work?

You take a 10-minute break to stretch and relax during a busy workday. Afterward, you feel…

Recharged

After a long day, you finish folding a pile of laundry. Looking at the neatly stacked clothes, you feel…

Satisfied

After spending a long time tidying up your room, you are exhausted, but when you look around you feel…

Proud

You've been out doing errands for hours. As you return home, you feel…

Satisfied

Did you feel satisfied after you've been out doing errands for hours?

You had a long day filled with various activities. In the evening, you sit down and reflect on your day. You realize that despite feeling physically tired, you have been quite…

Productive

Did you feel productive after you had a long day filled with various activities, despite being physically tired?

You usually get the bus to work but today you are feeling energetic and decided to walk. When you come home from work you feel more tired than usual. You think tomorrow you will feel....

Better

On holiday, you decide to visit a local museum. You spend hours walking around, marveling at the different displays. When you finally get home in the evening, you feel...

Fulfilled

Leading up to an important deadline, you've been spending more time working than usual. You notice you start to get sleepy sooner than normal. You think that the effort is…

Valuable

After a tiring day at school, a friend has just asked you to go for a walk with them. You think the walk would be...

Enjoyable

You take a quick 20-minute nap after a physically demanding day. Afterward, you feel…

Restored

Did you feel restored when you took a quick 20-minute nap after a physically demanding day?

You have been working hard all day to get the house ready for some guests who are coming to stay tomorrow night. You feel...

Accomplished

You wake up after a night of sleep. You take a deep breath and notice that you feel…

Refreshed

Did you feel refreshed after you woke up after a night of sleep?

You do some light stretching or yoga after a busy day. Afterwards, you feel…

Revitalized

You are going on holiday tomorrow and have had a busy day packing. When your alarm wakes you up in the morning, you feel...

Excited

Interpretation Bias Measurment

1. You go grocery shopping after a long day at work, and you're feeling mentally and physically drained. As you reach the cashier, you realize you forgot an item. You think to yourself…

   I can quickly go back and get it without any issue.

   I am too tired to go back and get it; it's just not worth the effort.

   The store layout made it easy to miss things, but I can still handle it.

   I always forget things when shopping, and it's just too much for me when I'm tired.

2. You've had a busy day and now need to attend a social gathering. You think…

   It'll be great to unwind and enjoy the company.

   I'll just sit there and try not to fall asleep; I'm too tired to enjoy this.

   I can try to focus on having fun with the people and try to ignore that I am tired

   Socializing always feels exhausting, and it's worse when I'm already tired.

3. You need to plan for an upcoming trip, but you're mentally and physically drained. You think…

   I'll make a list and take it step by step; I'll feel better once I'm prepared.

   I can't deal with this right now; I'll worry about it later.

   A little planning now will save me stress later, even though I'm tired.

   I'll just leave it to the last minute; I can't focus when I'm this tired..

4. You overslept and are running late for an important meeting. When you arrive, you notice people looking at you. You think…

They understand that being late happens sometimes.

They are annoyed that you wasted their time.

They are thinking about something unrelated to you.

They believe you are unreliable.

5. You've been working all day, and your desk is a mess. You think…

   A quick clean-up will help me feel more organized for tomorrow.

   I'm too tired to clean; I'll do it when I'm more energized.

   Cleaning my desk will only take a few minutes, and I'll feel better afterward.

   I always leave it until the next day; I'm too tired to care right now.

6. You're preparing lunch after a busy morning, and you're feeling physically fatigued. You think…

   A healthy lunch will give me energy for the rest of the day

   I can't even think about cooking right now; I'm too exhausted to make anything.

   I can make something simple and still feel good about it, even when I'm tired.

   I never feel like cooking when I'm this drained; it's just too much work.

7. You try learning something new but struggle initially. You think…

   This is part of the learning process.

   I will never get the hang of this.

   I just need more practice.

   I'm just not good at learning new things.

8. You sit down to watch TV after a long workday, but you're physically drained. You think…

   This will help me unwind and relax; I'll feel better afterward.

   I'm too tired to focus on anything; I just want to sleep.

   Watching something light will give me a break, even though I'm exhausted.

   I'll probably fall asleep in a few minutes; I'm always too tired to enjoy TV.

9. You need to do some chores at home, but you're feeling physically exhausted. You think…

   I'll do it now and it'll feel good to have everything done.

   I'm too tired to clean; I'll do it when I'm more energized.

   I'll do the chores in stages, and it won't feel as overwhelming.

   I can't be bothered to do anything when I'm this tired; it's just too much.

10. You try learning something new but struggle initially. You think…

    This is part of the learning process.

    I will never get the hang of this.

    I just need more practice.

    I'm just not good at learning new things.

11. You've had a long workday, and now you need to attend a Zoom meeting. You think…

    I'll stay focused, and get through this, its an important meeting.

    I can't focus on this right now; I'm too mentally drained.

    I can try to participate a little, even though I'm exhausted.

I'll just zone out; I can't stay engaged when I'm this tired.

12. You realize you missed an important deadline. You think…

I can communicate and try to fix this.

This proves I'm bad at time management.

Everyone forgets sometimes.

This will have severe consequences.

13. You're trying to read a book, but you've had a long day, and you're feeling mentally exhausted. You think to yourself…

I'll take it slow and focus as much as I can; I'll feel better after I read a little.

I can't concentrate at all; my mind is too tired to focus.

I can still make some progress, even if I'm feeling a bit drained.

I'll probably just fall asleep; I never seem to get through books when I'm this tired.

14. You've been working all day, and your desk is a mess. You think…

A quick clean-up will help me feel more organized for tomorrow.

I'm too tired to clean; I'll do it when I'm more energized.

Cleaning my desk will only take a few minutes, although I am tired.

I always leave it until the next day; I'm too tired to care right now.

15. You have a few errands to run, but you feel physically drained. You think…

I will do it step by step and can be proud for achieving something.

I'm too tired to run errands; I'll do them another day.

I'll just power through.

I'm always too exhausted for errands; I don't have the energy for this.

16. On the weekend you wake up later than you planned. You think…

    I clearly needed the rest, and I still have some time of the day left.

    I have no self-discipline.

    It's okay, I'll still make the most of the day.

    I've wasted the whole day.

17. You're attending a family gathering, but you're mentally and physically exhausted. You think…

    It will be nice to relax and spend time with family.

    I just want to go home; I'm too exhausted to enjoy this.

    I'll enjoy the family time, even if I'm tired.

    I'm always too tired to enjoy family gatherings; I'm not in the mood.

18. You get a phone call from a friend, but you're mentally exhausted. You think…

    I'll take the call; talking to my friend will help me feel better.

    I'm too tired for a conversation; I'll call them back later.

    A short chat won't take much energy.

    I can't focus on the call; I'm just too tired to talk.

19. You need to walk to the store, but your body is tired. You think…

    A walk will help me feel refreshed.

I'm too tired to walk; it's too much effort right now.

I have to go, maybe it won't be as bad as I think.

I always feel exhausted after walking; I don't have the energy for it.

20. You did not sleep well, and now face an unexpected problem at work. You think…

I've handled difficult situations before, and I can do it again.

I'm too drained to think straight; I won't be able to deal with this.

I'll take it one step at a time; it's manageable, even though I'm exhausted.

There's no way I can handle this now; my fatigue is just too overwhelming.