

University of British Columbia

Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

Don't worry, be hungry?

Assessing the relationship between pro-environmental behaviour and eco-anxiety using Climate-Friendly Food Systems labels

Prepared by: Kirsten Wesselow

Prepared for: UBC Food Services and UBC Botanical Gardens

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Executive Summary

Eco-anxiety has previously been associated with increased pro-environmental behaviour, while higher situational control has previously been associated with lower levels of worry. The present study sought to identify whether presenting participants with a specific highly controllable pro-environmental behaviour - the use of climate-friendly food systems (CFFS) labels to inform food choice - would lead individuals with higher levels of eco-anxiety to embrace the behaviour to a higher degree. The traffic-light-style CFFS labels, where level of greenhouse gas emissions was indicated by a green, yellow, or red label, were implemented in a survey-based shopping task, as well as in a university dining facility. In the survey, eco-anxiety level was assessed after the introduction of CFFS labels. Exploratory data including climate concern, pro-environmental intent, race, gender, and age were also collected in the survey. In the dining facility, the labels were added to the facility's menu after a period of baseline data collection, and a poster featured at the dining facility described the meaning of the labels to customers. An Instagram marketing campaign was also used to promote understanding of the labels. The survey study found that on the shopping task, food choice was significantly impacted by the CFFS labels. A small positive and marginally significant relationship was found between the pro-environmental behaviour of individual change in food choice and eco-anxiety. In assessing the relationship between pro-environmental behaviour and the secondary variables, no relationships were found. However, a moderate positive and significant relationship was found between eco-anxiety and both pro-environmental intent and climate concern. It is possible that, because the shopping task was hypothetical, a different relationship may have been found between pro-environmental and eco-anxiety in a real-world setting, where the impact of the labels may not have been as large. In the university dining facility, the food labels were related to a significant increase in red item sales, a significant decrease in yellow item sales, and no change in green item sales compared to baseline sales data. Though these results may be due to a genuine relationship between the presence of CFFS labels and a decrease in pro-environmental food choices, these results may also be related to the fact that baseline data and intervention data were collected in different seasons and during periods associated with different levels of stress. The discrepancy between label-informed change in food choice on the survey and at the dining facility indicates the need for further research on demonstrated rather than self-reported pro-environmental behaviour.

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List of Abbreviations

Climate-Friendly Food Systems (CFFS)

Greenhouse Gas (GHG)

Climate Change Worry Scale (CCWS)

General Intention to Act Scale (GIAS)

Introduction

In the wake of climate change, the consequence of possible environmental collapse to the point of uninhabitability on Earth looms. The cultural awareness of the deleterious effect of climate change, and how humans have caused it, has now been prominent for over five decades, yet efforts to mitigate the effects of climate change remain insufficient (Kellogg, 1975). In 1978, the National Defense University of the United States published a book on potential climate change scenarios projected to the year 2000, which included warnings of fluctuations in temperature, precipitation. Today, these scenarios have been widely confirmed as significant weather events occur worldwide multiple times a year, and the threat of mass environmental destruction due to these changes in climate has begun to seem much closer than before (e.g., Zhai et al., 2019; Solomon et al., 2007).

Exposure to these frequent significant weather events has contributed to states of worry that may not be as adaptive as the normal human state of worrying. This concept of worry that is specifically directed towards the environment is often referred to as climate change worry or “eco-anxiety” (Stewart, 2021). Worrying in general is natural to humans, and in different contexts worry can act as both a motivator and a hindrance. In the context of planning ahead to avoid life or death consequences, worry can motivate individuals to plan and take goal-directed actions (Sweeney & Dooley, 2017). However, many individuals are susceptible to a heightened state of worry so great that they feel debilitated, which prevents them from taking action, and this further increases their state of worry about impending events (Watkins, 2008).

Accordingly, when individuals maintain this heightened state of worry, their ability to take effective actions, both in the present and the future, is compromised. The relationship between worry and action is mediated by individuals’ belief in their own efficacy, which is the feeling that their actions can overcome a future threat or setback. This mediative effect of efficacy on worry is reflected in Lazarus and Folkman’s (1984) theory of stress, appraisal, and coping. In this theory,

the feeling of stress is bound to the appraisal of both the threat in the environment and one's own experiences. Inputs about one's past experience and one's efficacy in reacting to the situation feed back into the original appraisal to reshape it (Lazarus & Folkman, 1984). Lazarus further developed his stress appraisal model by arguing that two stages of appraisal are conducted – one that assesses whether the event is threatening, and another that assesses whether one has the resources to cope with the event (Lazarus, 1999). Having control in addressing stressors and challenges is thus suggested as a potential factor in protecting against prolonged worry (Tallis & Eysenck, 1994; Zimmermann et al., 2021). One may then infer that the relationship between anxiety, efficacy, and action is moderated by control, where feelings of control lead to higher beliefs in efficacy, and therefore lower degrees of anxiety and a higher likelihood to take concrete actions.

Some research suggests that eco-anxiety, as a form of worry, is a risk factor for feelings of hopelessness and lower problem-solving abilities around, and disengagement from, the threat of climate change (e.g., Stewart, 2021; Albrecht, 2011; Usher et al., 2019; Pikhala, 2018). A major symptom of eco-anxiety is what Albrecht (2011) called “eco-paralysis.” Eco-paralysis is described as the state in which individual levels of concern have risen so high that individuals are unable to act. Mental health professionals have also pointed out the potential impact of eco-anxiety on mental health services, emphasizing the necessity to develop effective eco-anxiety treatments to minimize its paralyzing effects (Usher et al., 2019).

Contrary to what theories of worry and climate action lead one to believe, alternative lines of research acknowledge the threat of eco-anxiety to personal wellbeing but highlight its potential role as a positive motivator rather than a source of paralysis. Indeed, many studies have found a positive relationship between levels of eco-anxiety and variables including and related to personal

efficacy. Surveys conducted on eco-anxiety have found that higher levels of eco-anxiety are associated with higher degrees of pro-environmental behaviour and worldviews, and individuals' beliefs in their own efficacy (Verplanken et al., 2020; Hicks & Holden, 2007). Milfont (2012) also conducted a longitudinal study in New Zealand to assess the direction of the relationship between knowledge of climate change, eco-anxiety, and efficacy. By assessing survey responses at three different time points, the study analyzed whether high amounts of one factor at one time point were related to increases in one or more of the other factors at future time points. The study found that knowledge of climate change predicted an increase in concern about climate change, and this increase in concern predicted a greater sense of perceived efficacy.

Efficacy is determined by the situation in which individuals are placed. As climate change is a broad situation over which no individual can have complete control, individuals may rely upon controllable situations, like reducing food waste, to feel efficacious in acting against climate change (Guerin et al., 2001). Hornsey and colleagues (2015) examined the relationship between individuals' general belief in their own efficacy and adaptive cognitions. In the study, individual control was manipulated by presenting participants with stories that either implied a high level of direct threat, or a downplayed level of threat. High levels of direct threat were associated with low levels of control, while downplayed threats were neutral. Threats were also framed to provoke feelings of individual responsibility or collective responsibility by referring to individual or societal calls for action, such as the individual behaviour of recycling, or the collective behaviour of reducing fossil fuel use in major corporations. The study then assessed individuals' levels of climate concern and levels of belief in efficacy. The study found that in situations of higher threat, versus downplayed threat, individuals were more likely to report higher feelings of climate concern and of belief in their own efficacy. The study therefore concluded lower feelings of control led to

higher levels of climate concern and to mitigate this lack of control individuals tended to overestimate their efficacy.

A much different relationship has been found among youth. On a self-report survey, individuals between the ages of 10 and 25 reported high levels of eco-anxiety, while also reporting low levels of reassurance in the efficacy of individual climate change action, and a sense of betrayal by the government in acting against climate change (Marks et al., 2021). The seeming ambiguity in the relationship between control and efficacy according to age group must be considered carefully, as the operationalization of control is not consistent across studies. Additionally, these studies did not include a measure of pro-environmental behaviour, therefore it cannot be determined whether the individuals who overestimated their own efficacy would be more likely to exhibit pro-environmental behaviours. With this rationale in mind, the impact of eco-anxiety on pro-environmental action is mediated may be mediated by their control over the situation. However, it has yet to be established whether lower or higher levels of feelings of control have a greater effect on the relationship between pro-environmental behaviour and eco-anxiety.

Research on individual responses to specific pro-environmental actions, such as reducing red meat consumption or water conservation, is necessary to understand what pro-environmental actions may not only aid in mitigating the negative impacts of climate change, but also contribute to a better understanding of how eco-anxiety presents in individuals. While previous studies on eco-anxiety and efficacy have looked at direct threats with low levels of control and downplayed threats with neutral levels of control (Marks et al., 2021; Hornsey et al., 2015), no study has considered the potential impact on eco-anxiety of situations in which the threat is not downplayed, but rather individuals are given clear, controllable choices that differentially impact climate change.

A promising avenue of research on situational control and pro-environmental behaviour focuses on climate-friendly food systems (CFFS) labels (e.g., Edenbrandt & Lagerkvist, 2021; Osmon & Thornton, 2019; Muller et al., 2019; Brunner et al., 2018; Feucht & Zander, 2017). In this field of research, researchers design graphic labels that are then put on menus, much like the leaf icons on menus that indicate whether a food item is vegetarian. All of these CFFS labels function on a traffic light scale, where a red version of the icon indicates the item produces high greenhouse gas (GHG) emissions, yellow indicates moderate, and green indicates low emissions (Edenbrandt & Lagerkvist, 2021; Osmon & Thornton, 2019; Muller et al., 2019; Brunner et al., 2018; Feucht & Zander, 2017).

In these climate labelling studies the decision to choose a food item based on its environmental impact is in the control of the individual. One study designed an experimental store with a catalogue of typical grocery items to assess individuals' choices in the absence of and presence of the CFFS labels, which reflected low, moderate, and high levels of nitrogen and carbon emissions, as well as water consumption (Muller et al., 2019). Participants were first given a catalogue that excluded CFFS labels and were instructed to fill up their baskets with whatever they liked. They then were given a new catalogue that featured climate labels. The researchers found that after being introduced to the labels, the average number of items associated with high GHG emissions selected by participants decreased significantly, while participants in the control group increased their average selection of items with high emissions in the second trial.

These results, and the results of similar shopping tasks and willingness-to-pay tasks, are salient, but due to the simulated nature of these experiments, it is difficult to generalize these results to real-world choice behaviours (Edenbrandt & Lagerkvist, 2021; Osmon & Thornton, 2019; Feucht & Zander, 2017). The unnatural quality of these experiments may have a weaker effect on

the dependent variable of choice, as the simulated effect may cause participants to feel less is at stake. Participants may also be more likely to rush through choices, or make decisions without thinking, if the shopping task is not occurring in a real-world setting.

One study to date has analyzed the effect of introducing CFFS labels on real-world purchasing behaviour. Brunner and colleagues (2018) collected data out of a student union restaurant at a university in Sweden. During the initial control phase, the researchers collected data on food choices in the absence of the CFFS labels. After one month of data collection, the researchers introduced the labels to the menu. The data collected in the experimental phase showed a significant increase in the choice of green, low emission food items, and a marginally significant decrease in the choice of red, high emissions food items. Information on gender was simultaneously collected, with no significant effects, but no other demographic information was collected. There may then be other significant demographic factors associated with environmentally informed food choice that were not assessed by this study. Because this is the only study of its kind that has been conducted, replication of the results is an important next step, especially in broader contexts. For example, the fact the study was conducted in Sweden may reflect the climate-conscious nature of the Swedish population, as compared to the more widely distributed views on climate change in a Canadian population.

Considering the breadth of research on how eco-anxiety may relate to pro-environmental behaviour, and research on food choice informed by CFFS labels, many ambiguities in the research warrant clarification. While the literature on both worry and eco-anxiety is consistent in its findings that efficacy beliefs mediate worry, the way in which efficacy is mediated by situational control is still unclear. It may be true that direct threats, rather than downplayed threats, lead to lower feelings of control and higher belief in efficacy, but the effect of higher levels of control has yet to be

considered. Indeed, if young people feel both low levels of control and low levels of efficacy, then establishing the effect of high situational control on feelings of efficacy is paramount. Therefore, replicating the effects of both simulated and real-world studies on climate labelling is the first step, as most previous research on this effect only provides a hypothetical understanding of the relationship between climate labeling and food choice alteration. By replicating the effect that CFFS labels lead to a change in food choice, one may infer that CFFS labels, which are meant to motivate individuals to take pro-environmental action, act upon individuals' beliefs in their own efficacy, and thus individuals who believe they can impact climate change may take action by altering their food choices.

The present study thus aims to clarify this ambiguity regarding the relationship between control, eco-anxiety, and pro-environmental behaviour, and to replicate the findings that CFFS labels lead to food choice alteration. These questions were addressed using two studies. The first study was a survey that addressed the relationship between control and efficacy-mediated eco-anxiety by first providing a simulated food choice shopping task, both excluding and including CFFS labels. The survey then collected information on the individual's knowledge of climate change, then measured eco-anxiety with questions from Stewart's (2021) "Climate Change Worry Scale" (CCWS), and subsequently measured pro-environmental intent with a modified question from Broomell and colleagues' (2015) "General Intention to Act Scale" (GIAS), and measured climate concern using Swim and Geiger's (2017) single-item self-categorization measure of opinion. Finally, the survey assessed demographic variables of age, gender, race, and affiliation with the university at which the study was conducted. The second study addressed the replicability of the effect of CFFS labels on food choice by collecting data at a university dining location, where CFFS labels were employed after a baseline period in which the labels were absent. The original

study design also included a control dining location which had a similar price range, menu, and distribution of GHG emissions across menu items, however no dining locations which fit these criteria were open to collaboration.

Based on previous research on relational factors of eco-anxiety, and on the impact of climate labelling, we predicted that in Study 1 there would be a positive relationship between levels of eco-anxiety and embracing the pro-environmental behaviour of using CFFS labels to inform food choice. These individuals would be more impacted by the ability to control their climate impact and would therefore demonstrate larger changes in GHG emissions associated with their choices between conditions. These individuals may also make up the majority of individuals who choose the items with the lowest emissions before the introduction of CFFS labels and choose the same item after the labels have been introduced. In Study 2, we predicted that we would see a similar effect to that found by Brunner and colleagues (2018), where the introduction of CFFS labels led to a change in the distribution of food items sold based on label colour.

Methodology and Methods

Participants

In Study 1, participants were 251 individuals obtained through a Qualtrics survey (M age = 28.53, SD age = 13.87, 67.33% women, 29.48% men, 3.19% nonbinary, 45.81% Asian, 39.44% White, 7.17% Mixed Race, 5.97% Hispanic, 1.59% Indigenous, 0.01% Black, .01% Arab), most of whom (93.23%) were affiliated with UBC. An additional 92 participants were excluded from data analysis for failure to pass attention checks or failing to complete the study. The target sample size of 1,000 participants was determined based on the sample size of the pilot study of the same nature that preceded the present study, in which we collected data from over 1,000 participants.

Participants were recruited via promotional emails, an Instagram post, and QR codes on promotional posters for the CFFS labels on UBC campus. Participants were not directly compensated, but those who wished were entered into a draw for ten \$50 gift cards.

In Study 2, sales data were used in place of participant data, where sales data were split between the baseline period of data collection, September 15, 2021 to October 17, 2021 ($n = 15,379$), and the intervention period of data collection, October 18, 2021 to December 8, 2021 ($n = 23,248$).

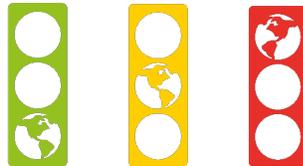
Materials

For both studies, a CFFS label was designed by the research team in collaboration with a graphic designer [see Fig. 1]. The design drew upon previous studies on CFFS labels and adopted the traffic light scheme that many of them implemented into their own labels (e.g., Edenbrandt & Lagerkvist, 2021; Osmon & Thornton, 2019; Muller et al., 2019; Brunner et al., 2018; Feucht & Zander, 2017). In a traffic light scheme, a green icon indicates low greenhouse gas (GHG) emissions, a yellow icon indicates moderate GHG emissions, and a red icon indicates high GHG emissions. GHG emissions were calculated based on the estimated carbon emissions necessary for the recipes of each menu item.

To establish which menu items were categorized under which icon, a baseline rate of carbon emissions was calculated based on UBC Food Services data from 2019. The baseline was 360.25 grams of GHG emissions per 100 grams of food. Following the guidelines of UBC's Climate Action Plan (University of British Columbia, 2021), items that produced under 50% of the baseline emissions were assigned green icons, items that produced 50-100% of the baseline emissions were assigned yellow icons, and items that produced over 100% of the baseline were assigned red icons. In general, items with beef, pork, or a combination of meat and dairy were red,

items that contained dairy, poultry, seafood, or eggs were yellow, and items that were plant-based were green. To accommodate for colour-blind individuals, the earth on the different coloured traffic lights were placed where the light would be on a real traffic light, with green being at the bottom, yellow being in the middle, and red being at the top.

Fig. 1



Note. Example of Climate-Friendly Food Systems Labels

Procedure

Study 1

Study 1 consisted of a survey designed to measure the effects of the CFFS labels on food choice and the relationship between food choice and eco-anxiety. All participants completed the same survey and no groups were assigned.

Before the target university dining location's menu was presented with and without the CFFS labels, participants were presented with the labels free of context and asked to describe what came to mind when viewing the icons. This measure was implemented to assess the strength of the labels in conveying meaning about climate change.

The study then employed a within-subjects design to assess the impact of CFFS labels on the choice of food items from the target university dining location. Participants first completed a shopping task where they were asked to imagine they were at a dining location and were presented with a menu with no CFFS labels, then they selected whichever menu item they would like to order. Participants were then presented with the CFFS labels and informed as to what each of the icons meant. They then were presented with the same menu, and again selected whichever menu

item they would like to order. In this shopping task, the independent variable was the condition, in which the CFFS labels were either absent or present, and the dependent variable was food choice.

Participants were then assessed on whether their knowledge from the previous section regarding which CFFS labels were assigned to what kinds of food items (e.g., red labels being assigned to items containing beef) transferred to a new menu. Participants completed a third shopping task in which they were asked to imagine they were in a different dining location, and to choose which item from a menu with no CFFS labels they would like to order. Participants were then asked to sort those menu items under the three different labels, assigning each item to the colour they expected it would fall under.

Next, an exploratory measure was added to assess what percentage of participants knew which individual action is the most impactful in addressing climate change. They were asked to rank three choices with 1 as the most impactful and 3 as the least impactful. The three actions included were, “reducing food waste,” “eating a plant-based diet,” and, “composting,” with “reducing food waste” being the correct first choice.

Study 1 then employed a correlational design comparing the change in choices informed by the CFFS labels and levels of eco-anxiety. Participants were assessed for eco-anxiety using items selected from Stewart’s (2021) Climate Change Worry Scale (CCWS). Items from the scale were selected based upon correlation, factor loading, and relevance to the research question. The two items that were chosen were, “I notice that I have been worrying about climate change,” which had a factor loading of .90, and “I worry about climate change so much that I feel paralyzed in being able to do anything about it,” which had a factor loading .75. The two items had high internal validity ($r = .80$). In terms of relevance, item one was selected because of its direct assessment of eco-anxiety, while item two was selected to assess the impact of eco-anxiety. Both items were

measured on a five-point frequency rating scale, with 1 being “Never” and 5 being “Always.” Participants’ total CWWS scores were calculated by adding together the scores for each question.

Because a change in food choice may be influenced by pre-existing intentions to take action against climate change, participants were then assessed level of pro-environmental intent using an item adapted from Broomell and colleagues’ (2015) “General Intention to Act Scale” (GIAS). The original item, “I will take actions to mitigate the negative effects of global warming,” which had a Principal Components Analysis loading of .84, was changed to, “I will take actions to mitigate the negative effects of climate change.” Global warming only describes changes in temperature associated with climate change, whereas the present study assessed climate change in terms of the temperature, precipitation, and wind patterns associated with the negative effects of food consumption. The adapted item was measured on a five-point Likert scale, with 1 being “Strongly Disagree” and 5 being “Strongly Agree.”

A final measure assessed climate concern, which differs from eco-anxiety in that it is measured by level of concern, not frequency of worry (Stewart, 2021). Concern was measured on a six-point scale using a single-item self-categorization measure of opinion (Swim & Geiger, 2017), with 1 being, “I am very concerned about climate change and think the government needs to act now,” and 6 being, “I do not believe climate change is occurring and certainly do not think humans have caused it. So, I’m not motivated to take or support action to address it.” The scale was designed by the researchers and took into account how level of climate concern may also involve a higher level of belief in the need to act and a higher level of urgency. For example, item three stated, “I suspect that climate change is happening but I am not certain. We have time to make careful decisions about when and whether to respond.” Sentence one assesses climate change

beliefs while sentence two assesses urgency and the type of actions needed to be taken – in this case, slower, more careful decisions made as a collective, rather than by government bodies.

Information on gender, age, race, and UBC affiliation was also collected as an exploratory measure to assess the relationship between demographic features and eco-anxiety and pro-environmental views and behaviours.

Study 2

Study 2 was a quasi-experimental study designed to assess the environmental validity of the same CFFS labels that were included in Study 1. As most of the previous studies on CFFS labels have only examined simulated shopping tasks and self-report measures (e.g., Edenbrandt & Lagerkvist, 2021; Osmon & Thornton, 2019; Muller et al., 2019; Feucht & Zander, 2017), the goal of the present study was to assess the effectiveness of the measure in university students, faculty, and staff on UBC campus.

First, sales data was collected at the target university dining facility for one month prior to the introduction of the CFFS labels. This provided a baseline estimate for the number of sales of each item without manipulation. CFFS labels were then added to the menu. After roughly two months the CFFS labels were removed from the dining location menu, and sales data for that period was collected for analysis.

Posters were also designed to be displayed at the entrance and at the cash register of the dining facility. These included an explanation of what each icon meant, and how to use them to inform food purchases. Due to a communication issue, the posters were not introduced at the dining facility until one week after the CFFS labels were introduced, but the data from this week was still analyzed. After the posters were in place, a video was filmed demonstrating how to read the CFFS

labels and use them to inform food purchases. The video was then posted to the UBC Foodie Instagram page, which is run by the UBC Food Services department.

A secondary control group was a campus dining facility with similar menu items to the test facility. Both the control and test dining locations featured similar items at a mid-range price point and a menu of around 15 items. Sales data collection began when the CFFS labels were introduced at the target and control dining facilities and ended after the labels were removed. At the control dining facility, no labels were implemented at any point during data collection. This measure provided us with a reference for what sales data were typical during the two months the CFFS labels were in place at the target dining facility.

Results

Study 1

Analysis of climate variable identification

In Study 1, 45.81% of the participants correctly identified the CFFS labels as traffic lights and 40.23% of participants interpreted the labels as relating to climate change. 55.38% correctly identified reducing food waste as the most impactful action in reducing GHG emissions, while 51.39% of the participants correctly identified plant-based diets as somewhat impactful, and 70.51% of the participants correctly identified composting as the least impactful action.

Coding of food items

Food item choice before introduction of the CFFS labels and after introduction of the CFFS labels was converted into GHG emissions per 100 grams. For example, the food item “Tortellini” in the shopping task would be converted to 417.973 GHG emissions per 100 grams. Outliers were not removed from the data due to the fact there was a large range in GHG emissions per gram

across the food items included on the survey, thus making it possible for values to vary greatly (Range = 1,503.61). The goal of the study design was also intended to reflect real-world buying behaviours, therefore high amounts of GHG emissions were a product of participants choosing many items. In this case, it was deemed meaningful to keep the data of these participants and understand how these choices relate to other variables.

Analysis of CFFS label impact

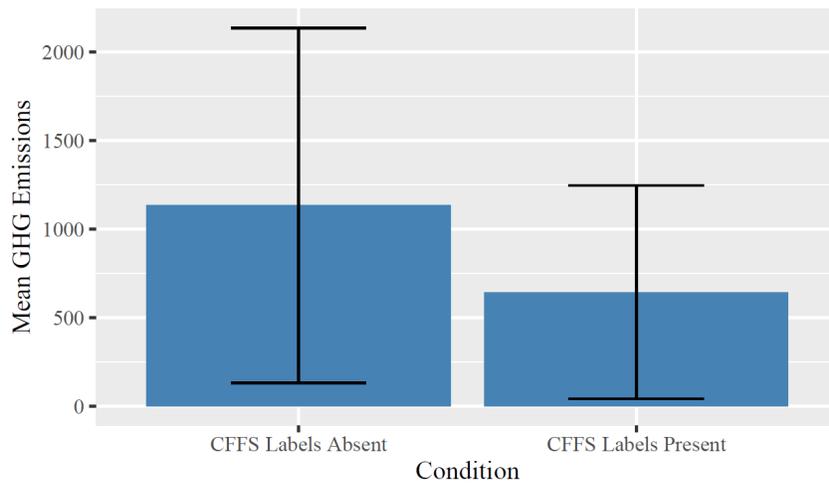
Table 1 shows the distribution of food choices across green, yellow, and red items before and after the introduction of CFFS labels. A paired-samples t-test was used to assess the impact of the CFFS labels on food choice. As predicted, there was a significant decrease ($t(250) = 9.76, p < .001, d = .54, 95\% \text{ CI } [0.43, 0.66]$) between the mean GHG emissions per 100 grams in the pre-CFFS-label condition (M = 1134.27, SD = 1003.11) compared to the post-CFFS-label condition (M = 644.99, SD = 602.11).

Table 1

Condition		Labels absent	Labels present
Colour	Green	56 (8.3%)	121 (23.4%)
	Yellow	280 (41.3%)	295 (57.0%)
	Red	342 (50.4%)	101 (19.5%)

Note. Summary statistics. Share of dishes selected by condition.

Fig. 2
Mean GHG Emissions by Condition

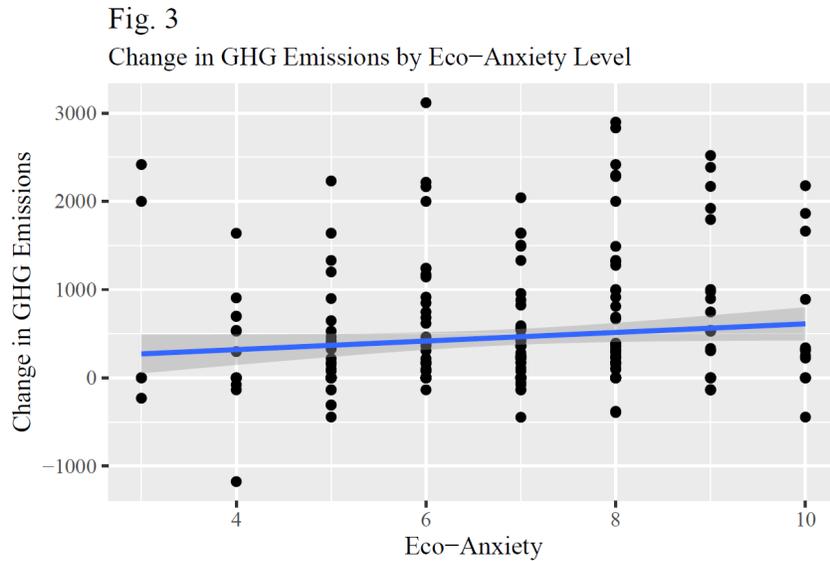


Coding of change in food choice

Post-CFFS-label GHG emissions scores were subtracted from pre-CFFS-label scores to obtain delta scores ($M = 489.28$, $SD = 794.15$), which were used to represent individual change in GHG emissions between conditions. Again, outliers were retained as a high change in GHG emissions may reflect important information about real-world purchasing behaviour.

Analysis of food choice and eco-anxiety

The delta scores for GHG emissions per 100 grams were used to assess the relationship between change in food choice ($M = 489.28$, $SD = 794.15$) and eco-anxiety ($M = 6.86$, $SD = 1.69$) using Pearson's correlation test. Somewhat consistent with what was hypothesized, there was a marginal small positive relationship between change in food choice and eco-anxiety ($r = .11$, $p = .098$). Participants with high delta scores, who had the largest change in GHG emissions of their food choices between conditions, reported only slightly higher eco-anxiety scores than those with lower delta scores.



Analysis of secondary survey variables

The relationships between delta scores and secondary exploratory variables included on the survey were also assessed using Pearson’s correlation test. These included climate concern and intention to act to mitigate climate change, or pro-environmental intent, which were coded using Likert scales. The nominal variables of gender and race were assigned numeric codes. For gender, “man” was coded as 4, “woman” was coded as 3, “non-binary” was coded as 2, and “prefer not answer” was coded as 1. For race, “White” was coded as 10. There was no relationship found between individual change in food choice and climate concern ($r = .07, p = .271$), pro-environmental intent ($r = .03, p = .642$), gender ($r = .05, p = .410$), race ($r = -.04, p = .490$), and age ($r = -.03, p = .646$). In summary, there was no relationship between any of the secondary exploratory variables and change in food choice.

According to analyses using Pearson’s correlation test, there was also no relationship between eco-anxiety and the demographic factors of gender ($r = .07, p = .245$), race ($r = .06, p = .315$), or age ($r = -.02, p = .769$). However, as predicted, there was a moderate positive relationship found between eco-anxiety and climate concern ($r = .40, p < .001$) and eco-anxiety and pro-

environmental intent ($r = .30, p < .001$), where higher eco-anxiety scores related to greater climate concern and greater pro-environmental intent.

The combined coefficient of determination was calculated with change in food choice as the criterion variable and eco-anxiety, pro-environmental intent, climate concern, and all demographic variables as predictor variables. The linear regression model indicated that a small portion of the variability in delta could be accounted for by the predictor variables ($R^2 = .02$). A model was also constructed predicting eco-anxiety from pro-environmental intent and climate concern. This model indicated a moderate portion of the variability in eco-anxiety could be accounted for by pro-environmental intent and climate concern ($R^2 = .21$).

Study 2

Analysis of food item sales and label presence

Table 2 shows the distribution of food choices across green, yellow, and red items before and after the introduction of CFFS labels at the university restaurant. A chi-square test was conducted to assess the association between the period of data collection – both during the absence of CFFS labels and the presence of CFFS labels - and the sales of food items associated with the three label colours. There was a significant association found between the period of data collection and food item sales by label colour, $X^2(2) = 179.95, p < .001$.

Table 2

Condition		Test restaurant baseline (09/15 – 10/17)	Test restaurant intervention (10/18 – 12/08)
Date (MM/DD)	Green	488 (3.2%)	859 (3.7%)
Colour	Yellow	6114 (39.8%)	7692 (33.1%)
	Red	8777 (57.1%)	14697 (63.2%)

Note. Summary statistics. Share of dishes sold by condition.

Changes in sales were then analyzed based on the colour of the label assigned to the items. There was a significant association between the presence of CFFS labels and the sales of red items, $X^2(2) = 22.91, p < .001$, with the proportion of red item sales increasing by 6.1% after the introduction of CFFS labels. There was also a significant association between the presence of CFFS labels and the sales of yellow items, $X^2(2) = 45.85, p < .001$, with the proportion of yellow item sales decreasing by 6.5% after the introduction of CFFS labels. No association was found between the presence of CFFS labels and the proportion of green item sales, $X^2(2) = 2.88, p = .237$, with sales remaining virtually unchanged after the introduction of CFFS labels.

Discussion

As studies on the phenomenon of eco-anxiety have increased in the past decade, it is important to understand how eco-anxiety relates to pro-environmental behaviours, as concerns have been raised over whether the phenomenon will help or hinder climate action. The present study aimed to better understand the relationship between eco-anxiety and pro-environmental behaviour by pairing a within-subjects shopping task using CFFS labels with a measure of eco-anxiety, as well as measures of climate concern, pro-environmental intent, and demographic variables. Simultaneously, the study sought to understand whether the effect of CFFS labels, which were intended to increase individual feelings of control in pro-environmental action, generalized from the virtual shopping task to a university dining location after being added to its menu.

Consistent with findings of previous studies on CFFS labelling, the GHG emissions associated with the choices of individuals on the shopping task prior to the introduction of labels were significantly higher than the emissions associated with choices after labels were introduced (Edenbrandt & Lagerkvist, 2021; Osmon & Thornton, 2019; Muller et al., 2019). Somewhat

consistent with what we predicted based on previous studies, individuals who reported higher levels of eco-anxiety changed their food choices, as informed by the CFFS labels, to a slightly higher degree than those with lower levels of eco-anxiety. Individuals who reported higher levels of pro-environmental intent and climate concern, however, did not demonstrate higher levels of change in food choice. Contrary to previous findings on the association between gender and low emissions food choices (Brunner et al., 2018), there was also no association between gender and change in food choice. The exploratory variables of age and race also yielded null results, with no relationship found between change in food choice and either variable. There was, however, a moderate significant positive relationship found between eco-anxiety and both pro-environmental intent and climate concern. This is a novel finding, as previous studies have primarily focused on the association between eco-anxiety and pro-environmental behaviour and sense of efficacy (e.g., Verplanken et al., 2020; Hornsey et al., 2015).

As Brunner and colleagues (2018) found, the presence of CFFS labels at a university dining location was not associated with a decrease in sales of red items, which were associated with the highest GHG emissions. However, contrary to Brunner and colleagues' (2018) findings of red item sales slightly decreasing, there was an increase in red item sales associated with the presence of CFFS labels in the present study. Consistent with Brunner and colleagues' (2018) findings, the presence of CFFS labels was also associated with a change in yellow item sales, with sales decreasing. Contrary to the previous study's findings of a significant increase in green items sales, green item sales were not affected by the presence of CFFS labels.

In Study 1, the significant effect of CFFS labels on food choice may indicate that the use of CFFS labels, when paired with a detailed explanation of their meaning, may lead most individuals to change their food choices to items with lower GHG emissions. The marginal positive

relationship between change in food choice and eco-anxiety may be interpreted to mean that the high degree of control allowed by CFFS labels is a strong enough manipulation to motivate most participants to exhibit pro-environmental behaviour, but the subset of individuals reporting high levels of eco-anxiety may have been slightly more affected by the labels and thus embraced them to a higher degree.

Due to the self-report nature of the survey, the small size and moderate significance of the relationship between eco-anxiety and pro-environmental behaviour may be related to demand characteristics or social desirability responding, where individuals who would not have changed their food choice deduced that the goal of the study was to enact a change in food choice and acted accordingly. Therefore, some participants may have indicated a change in food choice because they felt it is what the study expected of them, not because they genuinely desired to do so. If this is the case, it is possible that a stronger relationship between eco-anxiety and pro-environmental behaviour would have been shown if participants indicated whether they genuinely wanted to change their food choice after being exposed to the CFFS labels.

Because the effect of CFFS labels on change in food choice distribution did not generalize to customers at the university dining location, the potential impact of situational control on pro-environmental behaviour provided by the labels may have also been because not as much was at stake in a hypothetical shopping task. In fact, previous studies have shown that people's strong preference for taste in making food choices often outweighs their environmental concerns (Röös and Tjärnemo, 2011; Grunert et al., 2014). Therefore, it is possible that the control over one's pro-environmental decisions is reduced by the factor of taste in real-world applications of CFFS labels.

We considered the fact that, as we predicted, some participants who reported high levels of eco-anxiety would demonstrate no change in food choice, as these participants were vegan and

chose the sole vegan option in both conditions. If these participants represented a large proportion of the survey sample, this may have led to a false association between high eco-anxiety scores and both high and low differences in food choice between conditions, thus leading to a weaker relationship. However, after examining the data, we found that of the 72 participants who demonstrated no change in food choice, only 23.61% of those participants were those who chose the vegan option twice, therefore the proportion of individuals with high levels of eco-anxiety and low differences in food choice cannot be exclusively attributed to vegan individuals with high levels of eco-anxiety.

The findings from Study 1 build on previous research on the relationship between eco-anxiety and pro-environmental behaviour, as well as on the role of situational control in efficacy and action. The fact that the combined survey items were only able to account for 2.40% of the variation in GHG emissions associated with change in food choice implies that there are many variables involved in pro-environmental changes in behaviour for which the study did not account.

The novel finding that a moderate relationship exists between eco-anxiety and climate concern implies that, consistent with their similar definitions, the two variables may often co-occur in individuals. However, this relationship was moderate rather than large, which implies that the primary feature that differentiates the two variables – frequency of feelings of concern – does make a difference in whether individuals endorse both variables. For some individuals, climate concern may be high, but they may not be impacted by their concerns about climate change on as consistent a basis as individuals who endorse both high levels of climate concern and eco-anxiety.

Study 1 also determined a novel relationship between eco-anxiety and pro-environmental intent. The finding that higher levels of eco-anxiety relate to higher levels of pro-environmental intent support the argument that rather than hindering individuals, eco-anxiety motivates

individuals to act against climate change. The variable of pro-environmental intent may then relate to plans to increase pro-environmental behaviours, where individuals with higher levels of eco-anxiety may change their food choices to the same degree as individuals with lower levels of eco-anxiety, but they may plan to take other pro-environmental actions, such as reducing commute emissions, to a higher degree.

Study 2 determined an overall different effect than Brunner and colleagues (2018) in changes in food sales after the introduction of CFFS labels. Brunner and colleagues (2018) found the presence of CFFS labels was associated with a decrease in red item sales and an increase in green item sales. In the present study, while yellow item sales decreased after the introduction of CFFS labels, this decrease was offset by an increase in red item sales while green item sales remained unchanged. This difference in effect implies that CFFS labels may not have a replicable effect in real-world applications, when individuals' food choice will directly affect what they eat, especially seeing as Brunner and colleagues' (2018) findings did not indicate a strong effect of CFFS labels on overall sales trends. The trend in Study 2 may also imply that CFFS labels actually produce the opposite effect to what is intended, where individuals may be incensed by seeing labels that indicate GHG emissions and choose food items with labels that indicate higher emissions rather than lower emissions.

The findings of both Study 1 and Study 2 must be interpreted with caution, as they included significant limitations. Because of the correlational nature of the Study 1 self-report data, the direction of the findings cannot be determined. This means that while it is possible that the relationship found between eco-anxiety and change in food choice was due to the higher motivation of individuals experiencing eco-anxiety to embrace pro-environmental behaviour, it is also possible that the CFFS labels, which inherently bring up thoughts of climate change, caused

higher levels of eco-anxiety. For some participants, thoughts of climate change may have led to an inflated belief in their level of eco-anxiety, while others may have downplayed their reported levels of eco-anxiety to counteract feelings of stress brought on by thoughts of climate change. By not measuring levels of eco-anxiety before and after the shopping task, it is therefore not possible to determine how changes in food choice may have related to pre-existing levels of eco-anxiety.

Study 1 may have also been limited by the operationalization of situational control. Because there was no self-report measure introduced in which participants were asked about the level of control they felt in making food choices informed by CFFS labels, it is possible that it is not control that motivated participants to change their behaviour, but another variable that was not measured within the study.

In Study 2, a major limitation of the research design was the lack of a control dining location. While baseline data collected at the target dining location can be used as control data, the data differs from the test period data in the time of year in which it was collected. Previous research on food consumption trends has established a pattern of increased meat and dairy product consumption in the winter season (e.g., Joachim, 1997; Capita & Alonso-Calleja, 2005) as well as an increase in the consumption of fatty foods (Van Staveren et al., 1986). Seeing as items that contained high amounts of either meat or cheese were given red labels, the increase in red item sales between the baseline and test period may be associated with the fact baseline data collection was during the transition from summer to autumn, while test period data collection was during the transition from autumn to winter.

Increased consumption of fatty foods has also been associated with higher acute stress levels (Oliver et al., 2000). Because the test period data in Study 2 was collected during the months of October to December, this period would have been associated with both the midterm exam and

final exam period of the school semester, thus students purchasing food at the university dining facility would have likely experienced higher levels of stress than during the baseline period of data collection at the beginning of the school semester. The factor of stress therefore may have also contributed to the higher levels of red item sales during the test period. Additionally, the fact that green item sales, which contained a higher number of vegetables and plant-based proteins and a lower amount of fat, did not significantly decrease during the test period may indicate a potential small effect of CFFS labels, as previous research has found consumption of lower fat dishes usually decreases in winter and during periods of acute stress (Van Staveren et al., 1986; Oliver et al., 2000).

The findings in Study 2 may have also been confounded by the design of the labels. Because there was no control condition using different labels rather than no labels, it is possible that the increase in red item sales paired with the decrease in yellow item sales in Study 2 may have been related to the potential moralistic implications of traffic light labelling. The poster that was used to promote the CFFS labels referred to red items as the “least good” option to mitigate moralistic implications, however the association between red items and being the least good may still lead to feelings of judgement in many individuals. Seeing as the goal of the messaging around the CFFS labels was to promote purchases of the green item, the messaging may have been hindered by the sacrifice-based messaging, as it encouraged individuals to sacrifice high emissions items for lower emissions items (Gifford & Comeau, 2011). There may have therefore been a difference found between the use of traffic light labelling and the use of less moralistic labels, such as a single label to indicate low GHG emissions, had a control label condition been included (Gifford & Comeau, 2011).

The lack of an effect of CFFS labels on green item sales in Study 2 may also be related to the fact only one menu item featured a green CFFS label – the vegan item. In this case, individuals who may have wanted to choose a green item may have been dissuaded by the lack of choice they had, as choosing a green item meant individuals had to choose the vegan item.

The difference in the effect of CFFS labels on trends in food choice between Study 1 and Study 2 may have been related to the visibility and interpretability of the CFFS labels. The menu at the university dining location was positioned on the wall behind the service counter, which led to CFFS labels which appeared large on a computer or phone screen to appear much smaller. Given the fact that the only feature of the labels which linked to climate change implications was the earth featured in the stop light, this may have only looked like a circle from afar, and thus the labels would look like regular traffic lights. The poster which accompanied the labels and explained their meaning was not positioned on the wall behind the counter, but on the counter itself. Customers may then have not noticed the posters if their line of vision was exclusively being directed towards the menu.

Recommendations

Based on the findings of the current study, further research is needed on the relationship between eco-anxiety and demonstrated rather than hypothetical pro-environmental behaviour, as well as the role situational control plays in the matter. The findings of the current study also highlight the necessity of future studies on the impact of CFFS labels in real-world settings, as the results thus far have not been consistent.

Future studies should also consider the possibility that situational control may decrease feelings of eco-anxiety. Though eco-anxiety has been associated with pro-environmental behaviour in the past and has been associated with pro-environmental intent in the present study,

it is also associated with distress to the individual (Stewart, 2021). Identifying methods by which eco-anxiety may be reduced is thus a vital step in environmental psychology research, and a topic which at present is vastly understudied.

The present study revealed that the highly controllable activity of choosing a food item according to climate labelling may be marginally influenced by an individual's level of eco-anxiety. However, future studies with a higher degree of experimental control may reveal a more direct causal relationship between eco-anxiety and highly controllable pro-environmental behaviours, as this is a topic that has been previously unexplored.

Also previously unexplored were the relationships between eco-anxiety and both climate concern and pro-environmental intent. Based on the current study, it appears that high levels of eco-anxiety relate to high levels of climate concern and pro-environmental intent. This suggests that these factors may work together in determining the pro-environmental beliefs and intentions of individuals, and further research may identify how these factors work together in determining the extent to which individuals demonstrate pro-environmental behaviour.

Conclusions

Based on the present findings, it may be concluded that climate labelling on a traffic light scale can lead to the opposite effect than what is intended, where the presence of labels leads to an increase in sales of dishes associated with high greenhouse gas emissions and does not impact the sales of dishes associated with low emissions. This suggests the need for further research on how factors such as the design and promotion of labels can impact the effect of CFFS labels, as well as how to design labels with a strong enough influence to counteract the seasonal and stress-related effects on food choice.

The overall findings of the present study highlight the importance of studying demonstrated behaviour as well as self-report behaviour, as the trends in change in food choice are quite contradictory. By studying both demonstrated and self-report behaviour simultaneously, the present study was able to highlight potential hindrances to the effects of CFFS labels in real-world settings. Because the impact of CFFS labels on food choice in the self-report survey did not generalize to a real-world setting, it remains possible that eco-anxiety could have an even greater relationship with demonstrated pro-environmental behaviour than it does with hypothetical behaviour. This real-world difference could thus mark individuals with high levels of eco-anxiety as important figures in the global effort to mitigate the impact of climate change.

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