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Contents lists available at ScienceDirect

Resources, Conservation & Recycling

journal homepage: www.elsevier.com/locate/resconrec

Recycling and consumption reduction following the COVID-19 lockdown: The effect of threat and coping appraisal, past behavior and information

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ARTICLE INFO

Keywords:

Environmental behavior change
 COVID-19
 Recycling
 Sustainable consumption
 Information
 Consumption reduction

ABSTRACT

The COVID-19 pandemic has created sudden, rapid, and unprecedented change in almost every possible aspect of the general population's behavior. Despite its devastating consequences, the COVID-19 pandemic can alter individual behavior towards responsible environmental actions. This study provides an in-depth analysis of how the COVID-19 pandemic has changed pro-environmental beliefs and behavior. We compare pre-COVID-19 recycling and consumption reduction with post-COVID-19 intentions, focusing on the COVID-19 pandemic's role in catalyzing the change. The protection motivation theory is applied to investigate threat appraisal and coping appraisal as potential motivators for taking climate change more seriously and engaging in pro-environmental behavior. A tailor-made survey carried out during the national lockdown imposed in March–April 2020 in Israel served for the analysis. A generalized ordered probit estimated on a sample of 296 respondents served to validate the behavioral model. The results confirm that threat and coping appraisal are drivers of behavioral change towards pro-environmental behavior. The results show that: i) 40% of low-intensity recyclers are likely to increase recycling compared to 20% of high-intensity recyclers; ii) following the COVID-19 outbreak, 40% intend to consume less; iii) the changes are catalyzed by threat and coping appraisal; iv) taking climate change more seriously following the pandemic is a function of the individual's perceived association between COVID-19 and climate change, external knowledge, income loss due to the pandemic, self-resilience, and ecocentric beliefs; v) self-resilient attitudes lead to positive behavioral change, while anthropocentric beliefs impede changes towards sustainable behavior.

1. Introduction

The COVID-19 pandemic and the subsequent lockdown in many countries have created sudden, unprecedented change in the working habits, travel behavior, and consumption patterns of the population. The induced changes include air traffic reduction, minimal transport use, working and studying remotely from home, engaging in e-activities and activity reduction, limited ability to shop, and movement to e-shopping. The pandemic triggered the deepest global recession in eight decades, unprecedentedly impacting employment patterns, purchasing power parity (PPP), consumption patterns, and international trade. According to the global prospects economic report (World Bank, June 2020), the pandemic has induced an average decrease of 5.2% in the GDP, a 13.6% decrease in world trade, and a reduction of 4.1% in PPP estimates worldwide. The shutdown of entire industries has disrupted supply

chains and resulted in the collapse of businesses, increased unemployment, and decreased consumer confidence (World Bank, 2020). During the first quarter of 2020, due to workplace closure, shorter working hours, and temporary leave, an estimated 5.4% of global working hours (equivalent to 155 million full-time jobs) were lost. During the second quarter of 2020, the estimated loss rose to 14%. Hence, a significant portion of the population is suffering from severe income loss, economic uncertainty, growing debts, and purchasing power loss. While COVID-19 lockdowns around the globe have led to a 5% drop in greenhouse gas emissions, the COVID-19 pandemic, with monthly estimated use of 129 billion face masks and 65 billion gloves globally, is causing widespread environmental pollution. This waste adds to the 1.2–2.4 million tons of plastic waste afloat in the world's oceans (Prata et al., 2020).

With the slow return to a new routine, significant changes in consumer behavior are needed. The long-term course of action proposed by

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<https://doi.org/10.1016/j.resconrec.2020.105370>

Received 8 June 2020; Received in revised form 18 December 2020; Accepted 18 December 2020

Available online 7 January 2021

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the United Nations Environmental Program is to improve waste management and recycling, increase public awareness of the links between climate change, health, and sustainable living, accelerate sustainable consumption, encourage green and low-carbon behavior, and promote science and technology-based solutions (UNEP, 2020). Consumption patterns were already alarming before COVID-19. Global e-retail sales amounted to around US\$8 billion since 2013. Almost 40% of global internet users purchased products online in 2013 and the numbers continue to increase (Nisar and Prabhakar, 2017). Current food consumption patterns lead to extensive waste of food, ranging between 194–389 kg per person per year globally, with up to 25% of the loss derived from the consumption phase (Corrado and Sala, 2018). International air travel reached 3.7 billion passengers in 2017, and according to predictions, it will continue to grow at 4.7–5.2% per year (Elofsson et al., 2018; Becken and Carmignani, 2020), and lead to a 3.3.% increase in global greenhouse gas emissions from air travel (Elofsson et al., 2018). Depending on country-specific policy measures, these consumption patterns were abruptly interrupted during the COVID-19 lockdown period, with a staggering 30–60% decrease in work-related travel, 50–90% reduction in ground transportation, 20–80% decrease in grocery and pharmacy shopping, and 50–90% decrease in retail and recreation (Muhammad et al., 2020).

Rainear and Christensen (2017) argue that environmental problems such as climate change, often do not receive sufficient attention which is important to mobilize the general public because environmental issues, including climate change, are difficult to convey effectively, partially due to lack of public concern. Transition scholars have argued for the need for disruptive policies to break away from unsustainable energy, mobility, and consumption patterns (Kanda and Kivimaa, 2020). Following this notion, studies suggest that the COVID-19 pandemic can serve as a turning point for changing behavior and taking responsible actions and that the post-crisis period will serve as a decision period that enables a shift towards eco-friendly behavioral patterns (Muhammad et al., 2020; Sarkis et al., 2020). Bodenheimer and Leidenberger (2020) rephrase the narrative of COVID-19 as "a window of opportunity for sustainability transitions." Rosenbloom and Markard (2020) suggest advancing the climate agenda via economic recovery plans post COVID-19. Cohen (2020) postulates that "policymakers should work to ensure that the COVID-19 outbreak contributes to a sustainable consumption transition." Wells et al. (2020) and Goffman (2020) propose a different direction for such a transition. International institutions already promote these calls from academia. For example, the EU offers webinars on this topic and pushes for the implementation of the Green Deal. The OECD (2020) report suggests pathways for recovery and steps local governments can take, and city leaders worldwide are re-planning public spaces (The Guardian, 2020). As stated by Sarkis et al. (2020), while policymakers and organizations may shift to different production patterns and supply chains, these changes largely depend on consumer behavior. Sheth (2020) proposes three hypothesized consumer behavioral changes: returning to normal, decreasing consumption, and creating modified or new habits.

The present study is the first to explore the change in beliefs and behavioral intentions following COVID-19 towards more sustainable patterns, including consumption reduction and recycling. Recycling has been discussed from the perspective of demographic and community-level predictors (e.g., Seacat and Boileau, 2018), information provision, awareness and responsibility (e.g., Wang et al., 2018), norms, attitudes, and control (e.g., Sorkun, 2018), personality types (Poškus and Žukauskienė, 2017) and gender (Oztekin et al., 2017). Consumption reduction has been investigated in several sectors, including energy, retail, and food, by focusing on individual socioeconomic characteristics and social psychology theories. The applied theories include the theory of planned behavior, the norm activation model, the value-belief-norm theory, the integrative model for behavioral prediction, and the self-regulated behavioral change theory (Fishbein, 2009; Guo et al., 2018; Joanes, 2019; Klöckner, 2017; Ofstad et al., 2017). Since the

applied theories assume a "business as usual" scenario, a long time span for decision making, and slow behavioral progress over time, they are limited in predicting behavioral changes under an abrupt system shock. Similarly, current intervention strategies aimed at changing behavior (Maki et al., 2016; Timm and Deal, 2016) are mostly based on user fees and assume a "business as usual" scenario, rather than a deep-rooted structural change in societal norms and practices. The present study forms the first step towards exploring behavioral change from an abrupt system shock that triggers rethinking about current behavioral practices. Current motivational theories assume a steady state. We take a somewhat different approach and explore the protection motivation theory (PMT, Rogers, 1975) to model pro-environmental behavior. Because COVID-19 forms a threatening situation, it cannot be assessed under a "business as usual" scenario as the motivational triggers differ. PMT has an advantage for modeling pro-environmental behavior under conditions of an abrupt system shock. PMT describes behavioral changes that stem from the need to protect oneself in light of a threatening situation. Unlike most motivational theories that assume a multi-stage assessment and long periods for inducing behavioral change, PMT assumes abrupt situational changes catalyzing rapid behavioral change. So far, PMT has been applied to model pro-environmental behavior in steady-state conditions of slow-onset risks (Bockarjova and Steg, 2014; Rainear and Christensen, 2017; Shafiei and Maleksaeidi, 2020). The present study applies PMT to model behavioral change towards pro-environmental behavior under conditions of a global health and economic crisis that trigger rapid risk propagation and immediate reactions. We ask four main research questions. First, did the system shock induced by COVID-19 produce behavioral change? We investigate this possibility by comparing pre- and post-COVID-19 recycling and consumption reduction patterns. Second, did COVID-19 induce an attitudinal change? We explore this question by investigating threat appraisal and coping appraisal as motivators for taking climate change more seriously following the pandemic. Third, what are the relative effects of threat and coping appraisal on behavioral change towards recycling and consumption reduction? We explore this question by estimating a statistical model to validate the PMT hypotheses. Last, what is the effect of pre-COVID-19 pro-environmental habits on behavioral change for different levels of intensity? We investigate recycling and consumption reduction changes for three levels of behavioral intensity: low, moderate, and high.

The paper is structured as follows. Section 2 describes the development of the behavioral framework and the research hypotheses. Section 3 presents the data collection and the analysis method. Section 4 details the results. The last section provides a discussion and future research implications.

2. Behavioral framework

The present study focuses on intentions to increase or maintain consumption reduction and recycling behavior. The COVID-19 lockdown has imposed an abrupt decrease in activities, mobility, and consumption on entire populations. Because of the forced lockdown, temporary behavioral change can catalyze future intentions deriving from intrinsic motivations. Namely, the forced cessation of consumption is of interest as a catalyst for the internal decision to consume less and recycle more. Rather than focusing on the behavioral change during the lockdown, we focus on the post-COVID-19 intentions to change consumption and recycling patterns. The link between intentions and observed behavior was established in the theory of reasoned action, followed by the theory of planned behavior (Ajzen, 1991). While the gap between intentions and behavior can be explained by perceived difficulties (Ajzen, 1991), habit (Webb et al., 2009), situational influences (Klöckner and Blöbaum, 2010), intention formation, personality, and cognition (Sheeran, 2002), intentions serve as a behavioral plan and indicate the effort invested in taking action (Dixit and Badgaiyan, 2016). Nevertheless, empirical studies show that despite the occurrence of

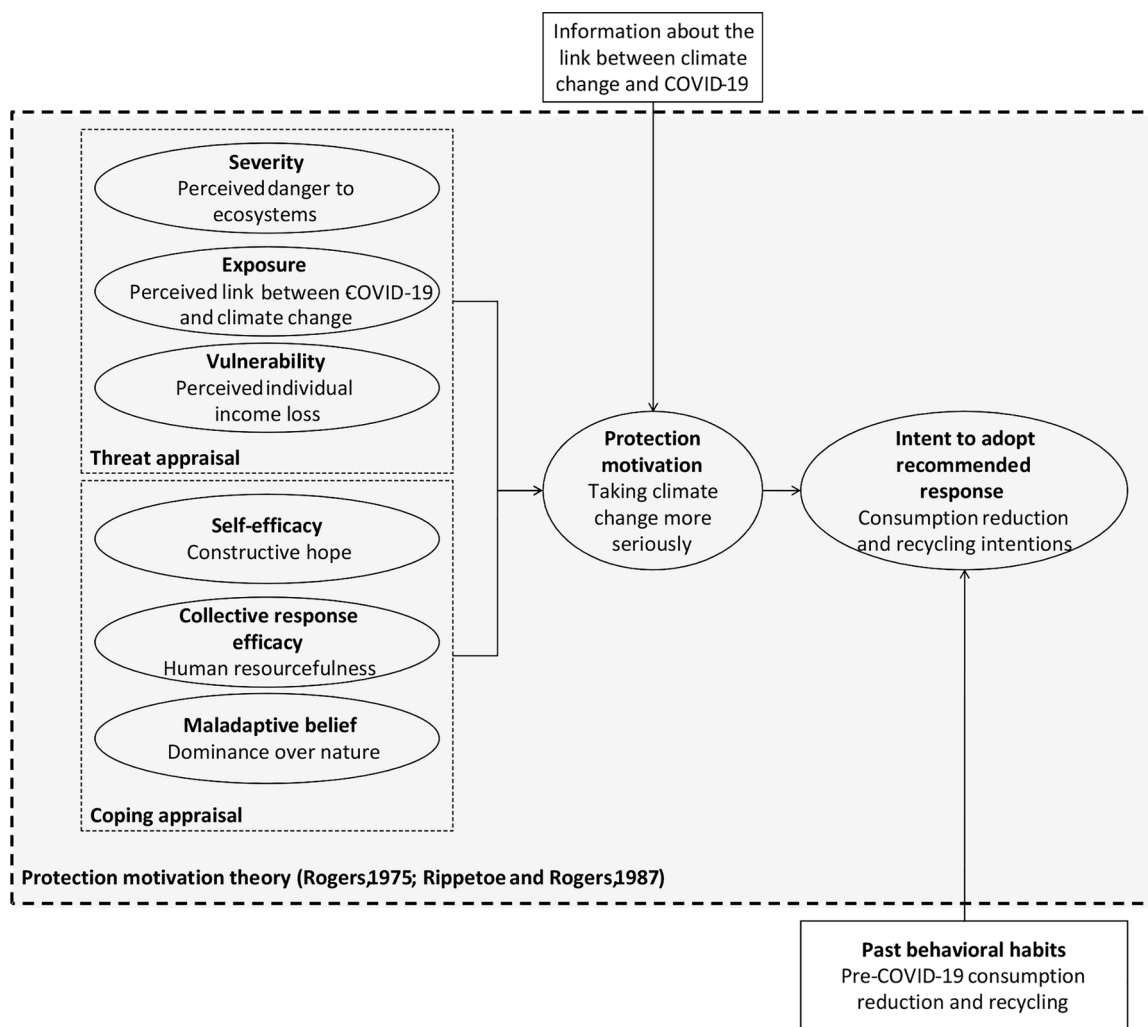


Fig. 1. Behavioral framework.

non-intended action and non-enacted intentions, intentions can predict behavior relatively well, and actions are much more likely when preceded by intentions (Cheung et al., 1999; Sheeran, 2002; Webb and Sheeran, 2006; Dixit and Badgaiyan, 2016). Several studies empirically validated the intention-behavior link in pro-environmental behavior (Boldero, 1995; Cheung et al., 1999; Bamberg and Möser, 2007).

In the present study, the chosen behavioral framework is based on the PMT, initially proposed by Rogers (1975) to study behavioral change following health-related risks. Rogers (1975) characterizes fear as a motivational state towards risk avoidance. PMT examines the notion of fear, looking at cognitive assessment leading to threat appraisal and coping appraisal, thus departing from emotions to utilitarian value expectancy. The appraised severity of the threat, the assessed occurrence and exposure probability, and beliefs regarding the coping response's efficacy arouse protection motivation and intent to take protective action (Rogers, 1975). Rippetoe and Rogers (1987) added perceived vulnerability and the possibility of maladaptive responses to both threat and coping appraisal. Coping response was originally related to self-efficacy and response efficacy (Rogers, 1975) and was then extended to include collective efficacy (Pakmehr et al., 2020) and social influence (McCaughey et al., 2017). PMT also considers maladaptive thinking patterns, including avoidance, denial of responsibility, wishful thinking, and hopelessness (Rippetoe and Rogers, 1987). PMT was extensively applied to explain behavioral intentions in numerous countries and several contexts, including health (see Milne et al., 2000), physical activity (see Bui et al., 2013), and eco-friendly behavior (see

Kothe, 2019). PMT has also proven valid under "business as usual" conditions for explaining lifestyle decisions, such as electric vehicle purchase (Bockarjova and Steg, 2014), responses to climate-change-driven water shortages (Permeh et al., 2020), and daily practices, using environmentally friendly transport modes, energy-saving, recycling, and reduction of disposable tableware (Rainear and Christensen, 2017; Shafiei and Maleksaeidi, 2020). Hence, PMT is suitable for describing environmental behavior under the pandemic risk.

Notably, PMT has been applied to predict both actual behavior and behavioral intentions. Hence, PMT is suitable for the current application, which involves consumption reduction and recycling. In the present study, we propose a modified version of PMT, as described in Fig. 1. We incorporate Cheung and colleagues' (1999) suggestion to include environmental knowledge and past behavior as antecedents. External situational factors are perceived income loss due to COVID-19 and external information about the link between climate change and COVID-19. Internal situational threat and coping appraisal includes taking climate change more seriously due to the COVID-19 outbreak and perceived self-resilience in reaction to the outbreak. In the context of pro-environmental action PMT considers a general environmental threat affecting entire populations. Under such conditions, individual behavioral assessment is rooted in ecocentric and anthropocentric beliefs (Taberner and Hernández, 2011). Thus, the current behavioral framework incorporates general environmental views as motivational factors.

Threat appraisal consists of perceived severity, vulnerability, and exposure expectancy. In the context of our study, threat appraisal refers to the appraisal of the threat that climate change poses to ecosystems and people. The perceived severity is captured by looking at the perceived environmental threat or danger to ecosystems. The ecological threat is measured by the perceived harm to ecological systems caused by current "business as usual" global trends of over-consumption of natural resources. Exposure expectancy usually refers to occurrence probability or the perceived possibility of exposure. In the context of our study, the exposure potential refers to health risks. Since COVID-19 had already occurred, the question is whether COVID-19 is perceived as related to climate change. At the time of the survey, the COVID-19 pandemic death toll was extremely low in Israel, but many people had suffered from income loss; therefore, vulnerability appraisal examined the perceived income loss.

Coping appraisal consists of beliefs regarding self-efficacy and collective response efficacy (Permehr et al., 2020). We include three types of response appraisal that have previously been found to be correlated with environmental behavior. The first is perceived self-resilience, combining problem-solving confidence and hope that the situation will improve in the near future. Problem solving and having constructive hope as proactive coping mechanisms were mentioned by [Prentice-Dunn and Rogers \(1986\)](#). The second is trust in others, namely the belief that human resourcefulness, research, and technical solutions will contribute to the improvement of the climate change problem. According to [Ojala \(2012\)](#), the belief in human resourcefulness, as part of the construct "trust in others," has been found to be positively correlated with environmental behavior. Collective resilience entails beliefs about human resourcefulness in coping with climate change and perceived human dominance over climate change. Notably, perceived resourcefulness implies the ability of human action to resolve the situational threat; thus, on the one hand, it may reduce concern, while on the other hand, it may trigger behavioral change. The third is the maladaptive belief in human dominance over nature. The proposition that human dominance over nature is a maladaptive belief with respect to pro-environmental behavior is anchored in the studies of [Milfont and colleagues \(2013\)](#) and [Zhang and colleagues \(2018\)](#). On the basis of the results of four studies, [Milfont and colleagues \(2013\)](#) argue that "A belief in human dominance over nature lies at the heart of the current environmental problem" and that "individuals high in social dominance orientation are more willing to exploit the environment in unsustainable ways." [Zhao and colleagues \(2018\)](#) show a negative relationship between human dominance over nature and ecological behavior. Human dominance over nature beliefs trigger neither concern nor action and thus encourage the "do nothing" approach.

Pre-COVID-19 behavior impacts future intentions and behavior directly due to habit formation that encourages behavioral reinforcement and automaticity, and indirectly due to its effect on attitude formation ([Ouellette and Wood, 1998](#); [Cheung et al., 1999](#)). Pre-COVID-19 recycling and consumption reduction habits serve as background control conditions. While they do not form an integral part of the original PMT, they provide ground conditions for the locus of possible responses. While evidence for the moderating role of past behavior in PMT is limited, the notion that we should control for past behavior while applying PMT is not new. Previous behavior and habits were considered as background conditions in the health literature (e.g., [Hodgkins and Orbell, 1998](#); [Umeh, 2004](#)), information security behavior ([Vance et al., 2012](#)), online safety ([Tsai et al., 2016](#)), and driving under the influence ([Abrantes Amaral et al., 2017](#)). Notably, past behavior has been established as an additional predictor in the theory of planned behavior. When added to the regression equation, past behavior is typically found to significantly improve the prediction of later behavior ([Bamberg et al., 2003](#)). However, the role of past behavior has not been investigated in a mega-crisis context leading to significant behavioral changes.

The influence of pre-COVID-19 behavior on future intentions is non-trivial and may be counterintuitive. For example, [Eriksson et al. \(2008\)](#)

reported the counterintuitive result that information intervention led to a larger reduction of car use among habitual car drivers than among occasional car users. They explained the result based on capacity hypotheses, namely, that heavy car users have more possibilities to reduce car use than light car users. In the present study, we postulate that pre-COVID-19 behavior intensity could be associated with commitment and capacity constraints. Low-intensity recyclers and consumption reducers have a lower commitment and larger change capacity. High-intensity recyclers and consumption reducers have a more substantial commitment and smaller change capacity. Individuals who practice a minimum level of pro-environmental behavior may find many opportunities to increase the intensity, but may lack the necessary commitment. People with a moderate level of pro-environmental behavior may have sufficient capacity and commitment. People with a high level of pro-environmental behavior may have the highest commitment, but the lowest capacity for additional change; we hypothesize that they would maintain their current level.

Information interventions aim at inducing voluntary behavioral change by changing individual perceptions. The role of information in threat appraisal was investigated by [Rogers and colleagues \(1978\)](#) for smoking cessation. The role of information seeking was found to be significant in other motivational theories, such as the theory of planned behavior. Thus, new information, if relevant and persuasive can change behavioral, normative, and control beliefs and can affect later behavior ([Bamberg et al., 2003](#); [Rosenthal, 2018](#)). [Prentice-Dunn and colleagues \(2001\)](#) investigated the role of threat information and coping information in the breast cancer coping response and found a significant effect. [Buceck and colleagues \(2018\)](#) found that providing risk and coping information can also positively affect coping with floods. Empirical findings across studies show that information provision leads to effective recycling ([Varotto and Spagnoli, 2017](#)) and food consumption reduction ([Reynolds et al., 2019](#)). At the beginning of the COVID-19 pandemic, opinions were expressed regarding the link between climate change and the pandemic. The [UN environmental program](#) published on its Twitter account a figure linking climate change and COVID-19 (<https://twitter.com/UNEP/status/1246709191663902722>; the tweet is provided in [Fig. A1](#) in the [Appendix](#)). At the beginning of the lockdown in Israel, articles in the three leading newspapers discussed the link between global warming and COVID-19, thus triggering such perceptions among the general population. Some of these conceptions can also be found in the scientific literature. [Mende and Misra \(2020\)](#) claim that "COVID-19 and global climate change are linked, and better understanding these linkages can (literally!) be vital for consumers, companies, and societies at large." More cautiously, [Brock and Xepapadeas \(2020\)](#) propose a modeling framework for unifying the economy, climate change, and the outbreak of infectious diseases such as the current COVID-19 pandemic. While there is no evidence regarding a direct link between climate change and COVID-19, the role of climate change in modulating the COVID-19 pandemic is the foci of scientific inquiry ([Ching and Kajino, 2020](#)). [Brzezinski and colleagues \(2020\)](#) used belief in climate change as a proxy for belief in science. They found a positive statistical relationship between belief in climate change and compliance with social distancing. Similarly, our study investigates whether the perceived link between climate change and COVID-19 directly affects taking climate change more seriously following COVID-19.

Research hypotheses derived from the framework are as follows:

H1. The perceived threat of the harmful consequences of climate change is positively associated with taking climate change more seriously and intentions to increase pro-environmental behavior post-COVID-19.

H2. Better perceived coping ability with the consequences of climate change is associated with intentions to increase pro-environmental behavior post-COVID-19.

Table 1
Sample socioeconomic characteristics.

Variable	Categories				
	Mean	SD	Min	Max	
Continuous variables					
Age	45.74	13.66	18	92	
Household size (number of persons)	3.59	1.57	1	9	
Number of children younger than 18 years old	1.24	1.37	0	7	
Categorical variables					
Gender	Male	Female			
	63%	37%			
Income level before COVID-19	Much lower the average	Lower than average	Average	Higher than average	Much higher than average
	3.4%	7.3%	16.4%	46.0%	26.8%
Education level	High school	Tertiary education	Bachelor's degree	Master's degree	Doctoral degree
	8.2%	10.7%	26.6%	38.1%	16.4%
Income loss due to COVID-19 lockdown	No income loss	Low degree	Moderate degree	High degree	
	45.0%	29.3%	15.7%	10.0%	
Locality type and size	Metropolitan core city	Large city	Small town	Urban community	Rural village
	45.9%	27.0%	9.3%	4.5%	13.3%
Housing type	Single detached house	2–4-storey building	> 5-storey building		
	40%	35%	25%		

H3. Following the COVID-19 lockdown, information about the possible link between climate change and the COVID-19 outbreak is positively correlated with pro-environmental behavior.

3. Data and methods

3.1. Survey design and administration

A tailor-made web-based survey served for data collection. The survey elicited pro-environmental attitudes and consumption behavior, behavioral changes, future intentions, and sociodemographic data. The survey included seven parts:

Environmental beliefs and attitudes were measured using the validated 15-item scale of the New Environmental Paradigm (NEP, Dunlap et al., 2000). The NEP scale has been applied in more than 36 countries and 140 separated samples over the last 40 years (Dunlap, 2008; Hawcroft and Milfont, 2010). Looking at the NEP through the PMT lens, ecocentric beliefs can be viewed as a threat appraisal, and anthropocentric beliefs can be considered a type of maladaptive coping strategy.

Personal threat and coping appraisal were assessed using the losses suffered during the lockdown and the belief in the possibility of recovery. The survey focused on perceived economic losses because soon after the COVID-19 outbreak and subsequent lockdown in the study country, the number of verified COVID-19 patients reached eight thousand, while unemployment due to lockdown reached one million (21% of the population age 20–64). The survey elicited the perceived extent of income loss and the perceived period for full income recovery. We elicited individual self-resilience with two questions about coping ability and optimism: "During this period, I feel I can cope with the problems I am experiencing" and "I estimate that my life will improve in the future."

Pro-environmental behavior was elicited for two time-points: pre-pandemic (past) behavioral trends and intended future pro-environmental behavior in the aftermath of COVID-19. We asked about the four most common recycling practices in the study region: recycling of paper, plastic, glass, and batteries. Buildings in urban areas have paper and plastic recycling containers, and most neighborhoods also have shared containers. Battery recycling containers are available at supermarkets and pharmacies. Glass bottles can be returned to shops for deposit return, and some neighborhoods also have glass recycling containers. Consumption reduction included energy saving and reduction of grocery shopping, overseas travel, and luxury shopping, the latter three restricted by the lockdown. The items were measured with a 5-point Likert scale. The measurement of pre-pandemic behavior consisted of

agreement statements (from 1 – "does not describe my habits" to 5 – "describes my habits very well"). For future intentions, the scale elicited the change compared to pre-pandemic behavior (from 1 – "much less than the pre-pandemic period" to 5 – "much more than the pre-pandemic period").

Taking climate change seriously following COVID-19 was measured with a 5-item scale: increased concern about climate change, having more faith in predictions about the effects of climate change, stronger acceptance that human actions have an impact on climate change, rethinking government responsibility in taking action, and feeling a stronger need for change in society at large following the COVID-19 pandemic.

Perceived knowledge regarding the linkage between climate change and the COVID-19 pandemic was measured with an agree/disagree 5-point Likert scale.

Information about the relationship between climate change and COVID-19 was supplied by providing the following statement: "Studies show that there is a relationship between climate change and the recent COVID-19 crisis. For example, studies claim that air pollution makes people more vulnerable to respiratory infections and that climate changes increase the proximity of humans to wild animals that can spread diseases. Examples are wildfires that destroy forests and natural habitats, leading to encounters between humans and animals that otherwise would not have taken place." The information did not include numerical information to make the responders feel comfortable in choosing to believe or disbelieve the provided statement. The information was randomly assigned to the respondents and was provided towards the end of the survey, with the preceding questions ascertaining only future intentions and perceived knowledge.

Socioeconomic characteristics included gender, age, education, household size, number of children, income, residence locality type and size, and housing type.

The survey was administered online through social media, the authors' social media accounts, and the authors' professional networks using a snowball effect during the six weeks of COVID-19 lockdown in Israel from mid-March until the end of April 2020.

3.2. Sample characteristics

The sample consisted of 296 completed and valid questionnaires (72% of the respondents who started the survey). Due to partial responses, only 23% of the sample received the above-mentioned information treatment. Table 1 details the sample socioeconomic characteristics.

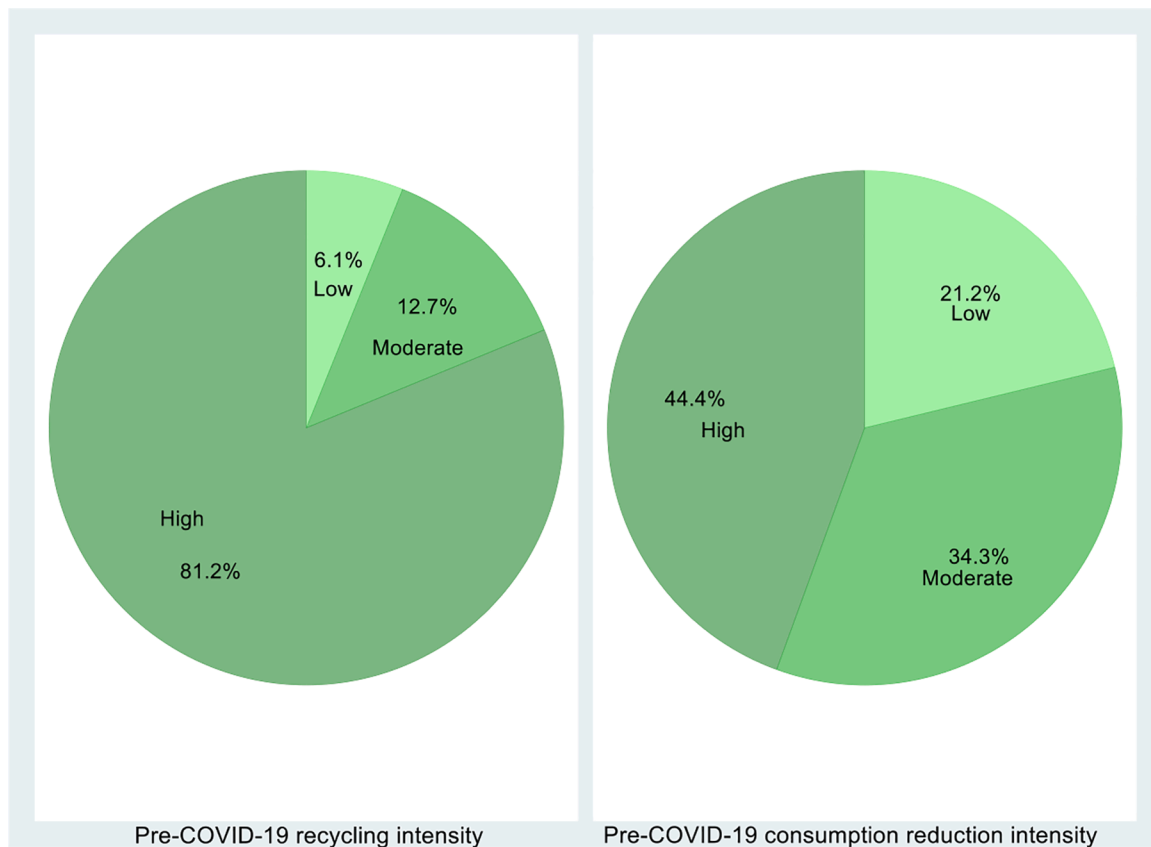


Fig. 2. Pre-COVID-19 pro-environmental behavior intensity.

The sample matches the national average household size and the national share of the population in urban areas (CBS, 2020), but other aspects over-represent middle-high-income families. The sample corresponds to the characteristics of wealthy families defined by Damari and Kissinger (2018a) in terms of household size, number of children, and education. According to Damari and Kissinger (2018a), while both high-income and low-income families represent 17% of households, their share of electricity consumption is 20% and 11% for high- and low-income families, respectively. Moreover, food consumption also increases with income and age, as wealthy families consume much more than low-income families (Damari and Kissinger, 2018b). Retail (clothing and furniture) consumption is 11–18% higher than the population average in the upper 7–10 deciles (CBS, 2020). Hence, a change among high-income families in recycling, consumption reduction, and eco-activism is desirable.

3.3. Econometric model

We estimated two models. The first model explains the recycling increase, and the second model explains consumption reduction change. The increase in recycling and consumption reduction can be treated as ordered categorical variables. In the present study, the dependent variables are future intentions. The explanatory variables are pre-COVID-19 pro-environmental behavior, perceptions, taking climate change seriously, and information. Because pre-COVID-19-behavior, environmental concern, and future intentions depend on similar perceptions and attitudes, they introduce endogeneity. We assume two sources of endogeneity:

- Pre- and post-COVID-19 pro-environmental behavior might be associated with the same explanatory variables. For example,

individuals with ecocentric views might exhibit general pro-environmental behavior and reach more pronounced decisions to increase their pro-environmental behavior in the future.

- The intended change in pro-environmental behavior and taking climate change seriously following the COVID-19 pandemic may derive from the same explanatory variables.

We performed the Durbin-Wu-Hausman test using STATA 15.1, which detected both sources of endogeneity. Hence, pre-COVID-19 behavior and taking climate change more seriously are treated as endogenous covariates. Instrumental variables were employed to represent these variables in the model. The chosen model form is the extended ordered probit regression model (eoprobit) using STATA 15.1. This model accommodates any combination of endogenous covariates, nonrandom treatment assignment, and endogenous sample selection. Continuous, binary, and ordinal endogenous covariates are allowed. The model included a structure of three simultaneously estimated regression equations. We used maximum likelihood to estimate the model.

4. Analysis results

4.1. Measurement of the behavioral constructs

We used confirmatory factor analysis and principal component analysis to measure the different constructs presented in the behavioral framework: pro-environmental behavior, threat and coping appraisal, and taking climate change more seriously.

Confirmatory factor analysis was applied using STATA 15.1 SEM routine (based on the maximum likelihood estimator) to reveal the constructs associated with the NEP environmental beliefs. Our analysis yielded three factors: 'ecocentric' views focusing on perceived danger to

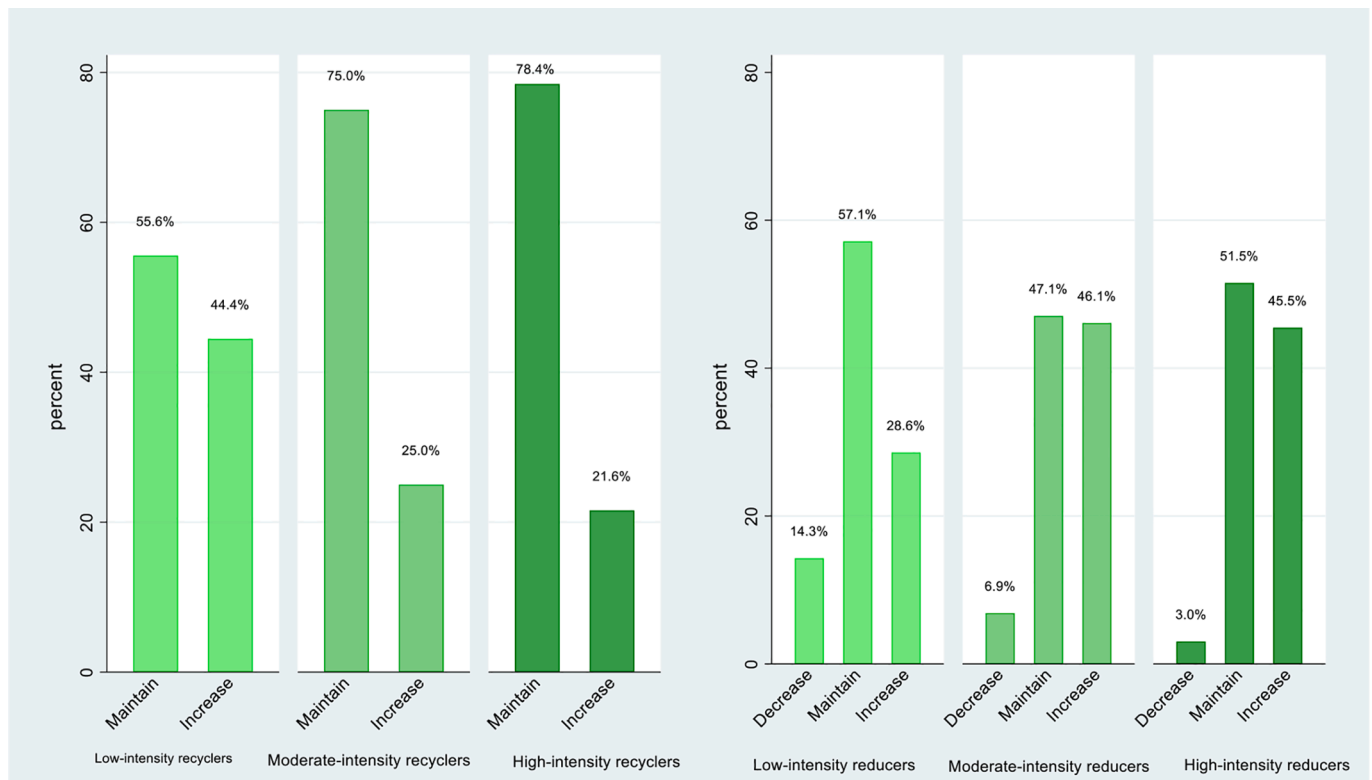


Fig. 3. Pre-COVID-19 and post-COVID-19 behavior for recycling and consumption reduction.

ecosystems, human resourcefulness for learning how to utilize natural resources, and anthropocentric beliefs focusing on human dominance over nature. The goodness of fit and reliability measures are: Cronbach's alpha = 0.775, $\chi^2 [161] = 35.36$, $P < 0.0001$, CFI = 0.965, TLI = 0.938, RMSEA = 0.061, SRMR = 0.0470. Seven items were removed from the estimation due to low factor loadings. Construct reliability and discriminant validity were confirmed. The factor loadings, AVE, and composite reliability are presented in Table A1 in the Appendix.

Pro-environmental behavior, taking climate change more seriously, and self-resilience were extracted using STATA 15.1's principal component analysis routine (varimax rotation with Kaiser normalization). The main factors were obtained for the pre-COVID-19 and intended pro-environmental behavior: recycling and consumption reduction. One factor was extracted for concern about climate change and another factor for sense of self-resilience. The factor loadings, AVE, squared correlation matrix, and Cronbach's alpha are provided in Tables A2–A4 in the Appendix.

4.2. Pre-COVID-19 pro-environmental behavior

Fig. 2 presents the pre-COVID-19 levels of recycling and consumption reduction. The correlation between recycling and consumption reduction is low for the low-intensity group (0.345) and moderate for the high-intensity group (0.523).

Fig. 2 shows that most of the respondents (81%) are habitual recyclers, while less than half report habitual consumption reduction. Considering that in 2018, 78% of small bottles and 60% of large bottles were returned by the public for recycling (Raz-Haimovich, 2019), the perceived recycling rate is reasonable.

4.3. Post-COVID-19 pro-environmental behavior change

Fig. 3 presents the changes in recycling and consumption reduction between the pre-COVID-19 pro-environmental behavior and future intentions. The correlation between maintaining the current recycling and

consumption reduction behavior is 0.797, and the correlation between increasing recycling and consumption reduction is 0.824. Hence, it seems that the COVID-19 system shock has similarly affected recycling and consumption reduction.

Fig. 3 reveals that regardless of the pre-COVID-19 recycling intensity, respondents intend to either maintain their current behavior or increase recycling, but they do not intend to decrease recycling. Almost half of the pre-COVID-19 low-intensity recyclers are prone to increasing recycling. In contrast, three-quarters of the moderate and high-intensity recyclers intend to maintain their current behavior, and only 25% intend to increase their behavior. While all three groups show behavioral commitment, the low-intensity group has a higher capacity for behavioral change. Interestingly, both the moderate and high-intensity groups have similar proportions of people who intend to maintain their behavior, which could mean that moderate recyclers are unaware of additional recycling possibilities or perceive further recycling as effortful.

The change in consumption reduction is much more pronounced than the change in recycling, as 28% of the low-intensity group and 45% of the moderate- and high-intensity groups are willing to increase their consumption reduction. The trialability effect (which in our case means that people experience a forced reduction in consumption during lockdown) and the perceived income loss and economic uncertainty may trigger this result. Interestingly, 14% of the low-intensity consumption group intends to increase consumption. This result may reflect either a lower commitment of this group to consumption reduction or maladaptive practices of emotional shopping. The moderate- and high-intensity consumption reducers show higher commitment since only 3–6% intend to revert to less sustainable practices.

4.3.1. Changes in recycling behavior

Table 2 presents the model results for increased recycling versus maintaining the current intensity. The model consists of three simultaneously estimated equations. Two equations represent the two endogenous variables: pre-COVID-19 recycling behavior and taking climate

Table 2
Recycling increase model results.

	Estimate	t-statistics	P-value
Auxiliary equation I: Pre-COVID-19 recycling behavior			
Age	0.018	79.82	0.000
Education	0.196	8.72	0.000
Threat appraisal			
Ecocentric attitudes – perceived threat to ecosystems	0.210	8.39	0.000
Coping appraisal			
Anthropocentric attitudes – human dominance over climate change	-0.112	-1.25	0.212
Ordered cut-offs			
Low–moderate	0.081		
Moderate–high	0.859		
Auxiliary equation II: Taking climate change more seriously following COVID-19			
Age	0.013	2.62	0.009
Male	0.455	9.55	0.000
Education	-0.200	-2.95	0.003
Threat appraisal			
Income loss following COVID-19	0.235	6.21	0.000
Knowledge regarding the link between climate change and COVID-19			
Did not receive information. Perceived link does not exist (reference category)	–	–	–
Did not receive information. Perceived link exists	1.513	3345.87	0.000
Received information (treatment effect)	0.727	708.45	0.000
Ordered cut-offs			
Low–moderate	0.187		
Moderate–high	1.247		
Dependent variable: Recycling behavior change			
Threat appraisal			
Taking climate change more seriously following COVID-19			
Low (reference category)			
Moderate	0.587	6.48	0.000
High	1.106	50.02	0.000
Coping appraisal			
High perceived human resourcefulness	0.144	6.41	0.000
Self-resilience	0.100	8.56	0.000
Interaction between coping and threat appraisal			
Resourcefulness * taking climate change more seriously following COVID-19	0.117	2.10	0.000
Pre-COVID-19 recycling behavior			
Low intensity (reference category)			
Moderate intensity	-0.912	-3.34	0.003
High intensity	-2.258	-6.25	0.000
Ordered cut-off			
Maintain–increase recycling behavior	-0.661		
Residual correlation structure			
Pre-COVID-19 – future recycling	0.659	4.38	0.000
Pre-COVID-19 recycling – taking climate change more seriously	0.064	4.00	0.000
Taking climate change more seriously – future recycling	-0.277	-6.61	0.000

change more seriously following COVID-19. The third equation explains the dependent variable – recycling increase. The recycling change model results are significant and confirm the hypothesized relations.

Threat appraisal: Ecocentric attitudes (belief in eco-crisis) represent the perceived threat to ecosystems following current "business as usual" human behavior trends. This belief is positively associated with pre-COVID-19 recycling behavior. Threat appraisal regarding the perceived link between climate change and COVID-19 affects taking climate change more seriously following the pandemic. The threat appraisal consists of perceptions and observations of loss. Internal perceptions or received external information about the link between

climate change and COVID-19 are associated with taking climate change more seriously following the pandemic. Respondents who suffered in income loss following the COVID-19 lockdown are more prone to taking climate change more seriously than respondents who did not suffer such loss. These results confirm H1.

Coping appraisal: The results confirm H2. Anthropocentric attitudes (human dominance over climate change) do not significantly affect pre-COVID-19 recycling behavior tendencies. Both individual and collective resilience affect future recycling intentions. Perceived self-resilience, namely the belief in individual ability to recover from the COVID-19 pandemic, is associated with intentions to increase recycling behavior. The belief in human resourcefulness positively affects intentions to increase recycling.

Interaction between coping and threat appraisal: In the recycling model the interaction between resourcefulness and increased concern over climate change following COVID-19 is positively correlated with increased post-pandemic recycling intentions. Hence, beyond the main effects of coping and threat appraisal, their interaction effect increases the motivation for recycling.

Pre-COVID-19 behavior represents both attitude manifestation and habit formation. Pre-COVID-19 recycling behavior is associated with intentions to increase recycling post-COVID-19. The low-intensity group is more likely than the moderate- and high-intensity groups to increase recycling. This result confirms that change capacity is as important as pro-environmental commitment. Possibly, because moderate and high recyclers are already recycling at their maximum capacity, the low-intensity group has more opportunities for behavioral change. The result also matches the change presented in Fig. 3.

Knowledge and information are positively associated with taking climate change more seriously, directly affecting concern, and indirectly affecting recycling intentions. As expected, internal conviction has a stronger effect than external information. Internal perceptions derive from an interest in the topic and efforts invested in obtaining information. External information is provided momentarily and does not necessitate any mental effort, and thus, its effect is less pronounced than that of internal perceptions. These results confirm H3.

Figure 4a shows the predictive margins of increased recycling with and without knowledge about the link between climate change and COVID-19 for low-, moderate-, and high-intensity pre-COVID-19 recycling. According to Fig. 4a, regardless of pre-COVID-19 recycling intensity, people without information are the least likely to increase recycling. At the same time, perceived knowledge entails a bigger change in motivation than external information. Fig. 4b presents the predictive margins of low, moderate, and high concern levels for low-, moderate-, and high-intensity pre-COVID-19 recycling. It shows that people who are profoundly concerned about climate change are more likely to increase recycling following COVID-19.

4.3.2. Change in consumption reduction

Table 3 presents the model results for increased consumption reduction. The model consists of three equations, simultaneously estimated. The equations represent the two endogenous variables, namely pre-COVID-19 recycling behavior and taking climate change more seriously following COVID-19, and the dependent variable – consumption reduction. The consumption reduction model results are significant and confirm the hypothesized relations. Hypotheses H1–H3 were also confirmed for consumption reduction.

Threat appraisal: The perceived threat is associated with pre-COVID-19 consumption reduction, taking climate change more seriously following COVID-19, and intentions to increase consumption reduction. Ecocentric attitudes, namely perceived threat to ecosystems, are positively associated with pre-COVID-19 consumption reduction. Income loss following COVID-19 and external information are associated with taking climate change more seriously following the pandemic. Taking climate change more seriously following the pandemic is associated with intentions to further reduce consumption.

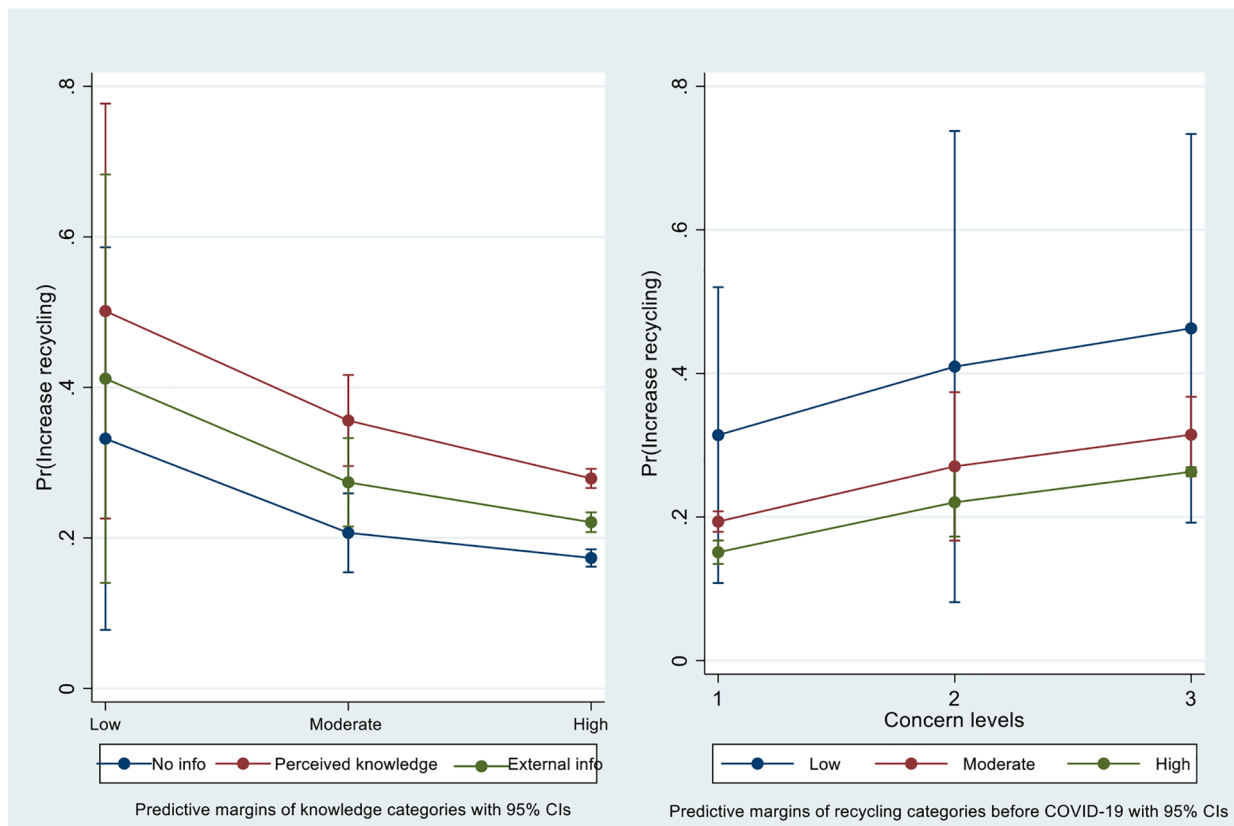


Fig. 4. a and 4b: Predictive margins for increasing recycling behavior.

Coping appraisal: Perceived coping ability is associated with taking climate change more seriously and increasing consumption reduction. Self-resilience is an adaptive coping strategy that combines individual responsibility and optimism. The results show that such a strategy leads to taking climate change more seriously following the pandemic, and thus, positively though indirectly contributes to consumption reduction. The collective coping strategy of high perceived human resourcefulness has a direct effect on consumption reduction intentions. However, anthropocentric attitudes are a maladaptive strategy. Perceptions of human dominance over climate change leads to less concern about climate change and does not lead to further consumption reduction.

Pre-COVID-19 consumption reduction: Compared with respondents with low-intensity pre-COVID-19 consumption reduction, respondents with moderate and high-intensity consumption reduction are more likely to reduce their consumption further. Hence, it seems that high commitment to consumption reduction pre-COVID-19 leads to more significant consumption reduction following the pandemic. During the lockdown (unlike in the recycling case) respondents experienced a forced consumption reduction. This reduction, along with suffered income loss, led to hands-on experience in consumption reduction. This experience is possibly associated with an increase in the perceived capacity for consumption reduction. The combination of greater perceived capacity and higher commitment lead to greater intentions of consumption reduction.

External information about the link between climate change and the COVID-19 pandemic is positively associated with taking climate change more seriously and indirectly affects recycling intentions.

Fig. 5a shows the effect of maladaptive coping appraisal (anthropocentric attitudes). An increase in the maladaptive coping appraisal, which reflects denial strategies, is associated with a lower propensity for post-pandemic consumption reduction. Fig. 5b shows the effect of

adaptive coping appraisal (self-resilience) on consumption reduction intentions. The propensity to increase consumption reduction is more significant for people with a stronger sense of self-resilience. Hence, self-resilience is an adaptive strategy that encourages individual responsibility for taking action.

5. Discussion and conclusion

5.1. Summary of the main results

The results show that following COVID-19, people are ready to increase recycling and further reduce consumption. About 40% of low-intensity recyclers and 20% of moderate- and high-intensity recyclers intend to increase recycling in our sample. About 28% of low-intensity consumption reducers and 45% of moderate- and high-intensity consumption reducers intend to reduce their consumption further. Hence, COVID-19 has not only strengthened the conviction among pro-environmentalists, but it has also had a strong effect on people who engaged in pro-environmental behavior with low intensity.

The results show that threat appraisal and coping appraisal motivate behavioral change. Threat appraisal involves the perceived severity (danger to ecosystems), the perceived link between exposure to the pandemic threat and climate change, and economic vulnerability. The threat appraisal triggers deepened concern about climate change as a result of the COVID-19 pandemic. Coping appraisal includes self-resilience and human resourcefulness as proactive coping beliefs, and human dominance over nature as a maladaptive strategy. Our results show that perceived self-resilience and human resourcefulness are positively correlated with an increase in pro-environmental behavior. In contrast, human dominance over nature is negatively correlated with such a change. Our results are in line with previous studies on proactive

Table 3
Consumption reduction intentions model results.

	Estimate	t-statistics	P-value
Auxiliary equation I: Pre-COVID-19 consumption reduction behavior			
Age	-0.034	-6.03	0.000
Age ²	0.000	18.17	0.000
Education	0.045	3.30	0.001
Threat appraisal			
Ecocentric attitudes – perceived threat to ecosystems	0.382	14.50	0.000
Ordered cut-offs			
Low–moderate intensity	-1.603		
Moderate–high intensity	-0.568		
Auxiliary equation II: Taking climate change more seriously following COVID-19			
Male	0.395	19.63	0.000
Education	-0.160	-2.86	0.004
Household size	0.055	4.33	0.000
Threat appraisal			
Income loss following COVID-19	0.298	11.13	0.000
Information regarding the link between climate change and COVID-19			
Received information (treatment effect)	0.041	2.53	0.011
Coping appraisal			
Self-resilience	0.134	3.13	0.002
Anthropocentric attitudes – human dominance over climate change	-0.205	-7.60	0.000
Ordered cut-offs			
Low–moderate	-0.520		
Moderate–high	0.364		
Dependent variable: Consumption reduction increase			
Threat appraisal			
Taking climate change more seriously following COVID-19			
Low (reference category)			
Moderate	1.000	3.72	0.000
High	1.923	10.11	0.000
Coping appraisal			
High perceived human resourcefulness	0.187	21.75	0.000
Pre-COVID-19 consumption reduction behavior			
Low intensity (reference category)	–	–	–
Moderate intensity	0.323	2.67	0.008
High intensity	0.414	117.64	0.000
Ordered cut-off			
Decrease–maintain	0.329		
Maintain–increase	1.688		
Residual correlation structure			
Pre-COVID-19 – future consumption reduction	-0.058	-0.60	0.551
Pre-COVID-19 consumption reduction – taking climate change more seriously	0.102	0.73	0.463
Taking climate change more seriously – future consumption reduction	-0.793	-11.97	0.000

and maladaptive coping strategies and pro-environmental behavior (Ojala, 2012; Milfont et al., 2013; Zhao et al., 2018).

Our study shows that the intended behavioral change varies across population groups. This result shows that the change is motivated not only by commitment, but also by the operational capacity for change.

Our study distinguishes between two types of knowledge: internal perceptions and external information. Both types appear to have a direct effect on the intention to change behavior and an indirect effect on growing climate change concerns. However, internal conviction seems to have a more substantial effect on taking climate change more seriously.

5.2. Policy and business implications

The 1973 oil crisis triggered an international debate about the effect of human behavior on climate change. The debate induced 40 years of

academic research, international and national policy decisions, activities of non-governmental organizations, and technology advancements. Yet, we see a slow and incremental change in human behavior. Despite forecasted catastrophes and recurring natural disasters in many parts of the world, humanity failed to initiate a large-scale change towards pro-environmental behavior. The current COVID-19 pandemic, which has caused a severe lockdown in 52% of countries globally, brings into focus the potential effect of behavioral changes on air pollution and the triability of consumption reduction.

Our study shows that both increased recycling and consumption reduction are feasible pro-environmental approaches which the general public is ready to pursue. The results indicate that 81% of the survey respondents consider themselves habitual recyclers. This score matches the fact that 78% of empty waste bottles are collected for recycling in the study region. Yet, recycling rates in Israel are low (~25%) due to a lack of recycling facilities, high recycling costs, and the composition of waste materials. Our results show that the public is willing to recycle more, so recycling rates must be improved. Manufacturers and suppliers should devise better recycling solutions to ensure that the gathered material is recycled. Policymakers should invest in better monitoring of waste disposal and separation, education, and incentives for recycling.

Our study points to the effectiveness of information and triability as measures for increasing pro-environmental behavior. It also shows that a considerable share of people who have not shown substantial interest in recycling and consumption reduction are willing to engage in more sustainable behavioral patterns. Nevertheless, while the system shock induced by the pandemic enhanced public awareness and willingness to act, long-term changes require continuous maintenance. Moreover, our results indicate that both commitment and capacity constraints may guide pro-environmental behavior. Current policymaking in Israel, the study region, mainly focuses on technological solutions rather than changing human behavior. Yet, the current pandemic has shown that relying on technology is only useful when coupled with societal change. Policymakers should seize the opportunity to support innovative measures for monitoring and reducing consumption. Such measures could include provision of information, including school programs, household consumption reduction, individualized consumption reduction plans, and nudging applications aimed at consumption reduction.

The results show that PMT is applicable to model pro-environmental behavior following a system shock. Thus, both threat appraisal and adaptive coping appraisal motivate positive changes in pro-environmental behavior. Interestingly, most campaigns and policies focus on the effect of threat appraisal. This approach has had limited effectiveness regarding behavioral change. Policymakers focus on science and technology to provide sustainable solutions, evoking maladaptive coping mechanisms among the general public. Our study indicates that coping appraisal is an essential aspect of behavioral change and that self-resilience and resourcefulness are essential drivers of individual responsibility. Pursuing policy measures and campaigns for coping appraisal by providing individualized solutions could encourage further advancements towards sustainable behavior.

5.3. Limitations

The considered PMT approach can be elaborated to include other constructs. Rippetoe and Rogers (1987) mention multiple maladaptive strategies that can be considered (avoidance, wishful thinking, hopelessness, and fatalism). Proactive coping can also be measured with more elaborated scales, such as the self-efficacy scale (Sherer et al., 1982) and the problem-solving inventory (Heppner and Petersen, 1982). While early versions of the protection motivation model do not include costs and rewards (Rogers, 1975), Rippetoe and Rogers (1987) and Bockarjova and Steg (2014) include costs and rewards of proactive and maladaptive responses. While in the context of paper or plastic recycling, costs and rewards are minimal due to the ease of recycling and

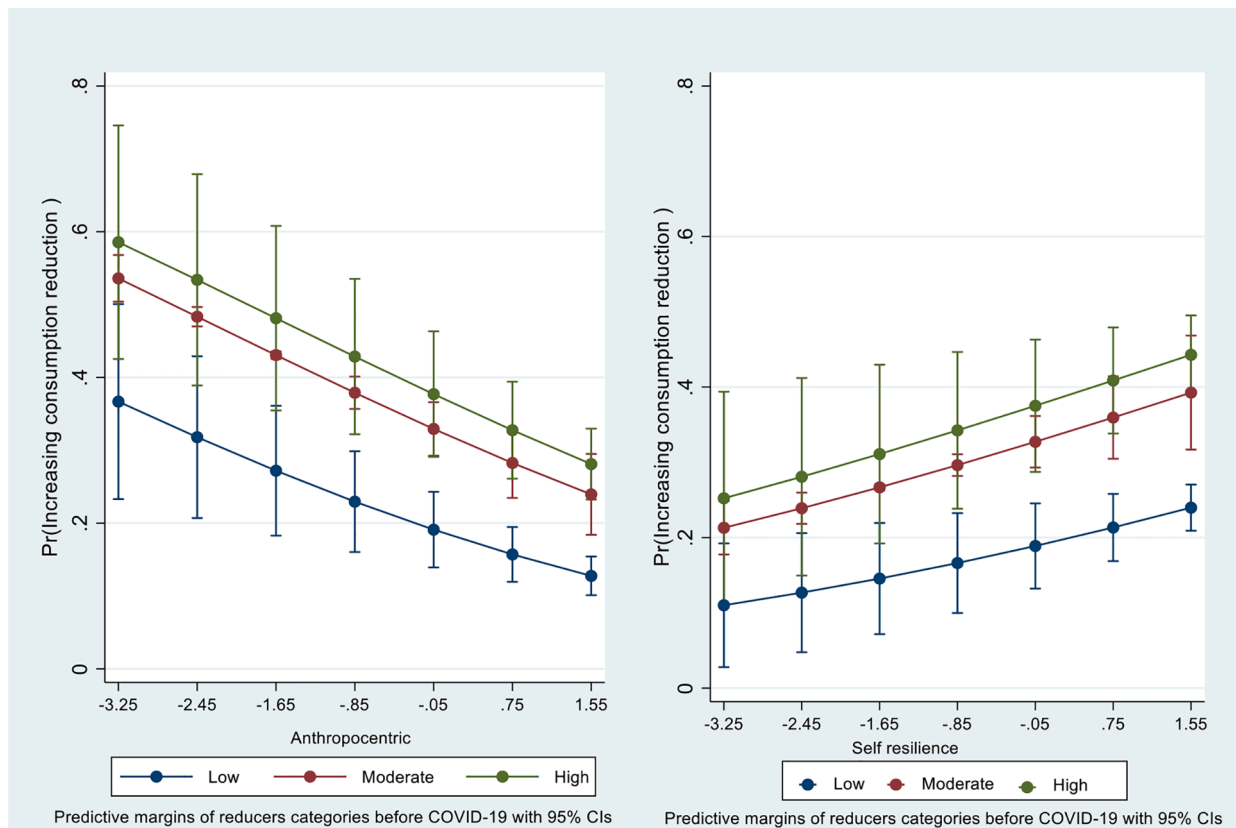


Fig. 5. a and 5b: Predictive margins for increasing consumption reduction.

lack of monetary gains, consumption reduction and other pro-environmental behaviors have high tangible and emotional costs and rewards.

Second, there is evidence that optimism and pessimism influence both threat and coping appraisal (Schou et al., 2005), hence threat and coping appraisal serve as mediators between optimism and the behavioral reaction to stressful situations, such as the current pandemic. This study does not consider the role of optimism - pessimism on threat and coping appraisal. It could be useful to explore the relationship in future studies.

Third, our results are based on a survey carried out in a single country (Israel), which was under complete lockdown during the months of March and April, and experienced a relatively low COVID-19 mortality rate during that period. Globally, lockdown measures were implemented in more than 100 countries (51.8%); hence, the survey results can be generalized to other regions. Nevertheless, the restrictions on activities and travel distances varied across countries worldwide. Whereas some countries suffered severe lockdowns, others were under limited or no restrictions, so consumption reduction was of a different magnitude. Moreover, COVID-19 mortality rates vary across regions. The rates of infection, the measures to fight the pandemic, and the levels of social and institutional trust may affect threat and coping appraisal. Hence, while the model form is transferable and the hypotheses are confirmed, the marginal effect size may differ across regions.

Finally, another limitation may derive from the population's sensitivity to natural disasters. This study was conducted in a Mediterranean country that is not exposed to other major catastrophic events or natural disasters. Other regions may suffer from frequent natural disasters,

which may affect the awareness and coping strategies of the populations. More research is needed to understand whether the frequency of natural disasters increases or decreases a population's sensitivity to such events and whether it encourages a greater sense of responsibility.

5.4. Future research

This research takes the first step in understanding how a crisis-induced system shock can affect pro-environmental behavior. Future research is necessary for a cross-country comparison of pro-environmental behavior changes following the pandemic. Future research should compare results from other countries to capture differences in national policy, cultural effects, and social and institutional trust. It is also essential to look at the behavioral changes from a longitudinal perspective. According to the transtheoretical model of behavioral change (Prochaska and DiClemente, 1982), behavioral change is a cyclic process that takes time, including contemplation, preparation, action, and maintenance. Looking at the 1973 oil crisis and subsequent policymaking, market reaction, and behavioral changes, decades are needed for population-wide and nationwide changes. Future research should explore whether long-term recycling and consumption reduction occur and how to cope with and overcome behavioral relapses. Panel data and national datasets should be used to measure household waste, consumption, and recycling to gather valuable information on pro-environmental behavior over time. A follow-up survey could also assess how the level of social and institutional trust affects threat and coping appraisal if the pandemic continues and the government's actions and ability to control the spread of the pandemic are

questioned (as in the current situation in Israel).

Big-data applications for measuring pro-environmental behavior are at their nascent stage (Elimelech et al., 2018), but could be useful for advancing the research on pro-environmental behavioral trends. Finally, the current COVID-19 lockdown has implications for life-cycle analysis. The newly found evidence for behavioral changes following system shocks could be embedded in life-cycle assessments, back-casting, and modeling transition scenarios towards a sustainable future.

Author statement

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administration

Declaration of Competing Interest

None.

Acknowledgements

The authors wish to extend their gratitude to the anonymous reviewers for their attentive review, which greatly helped to improve the current version of the manuscript. Their insightful comments, effort and dedication are highly appreciated.

Appendix

Fig. A1, Table A1, Table A2, Table A3, Table A4.

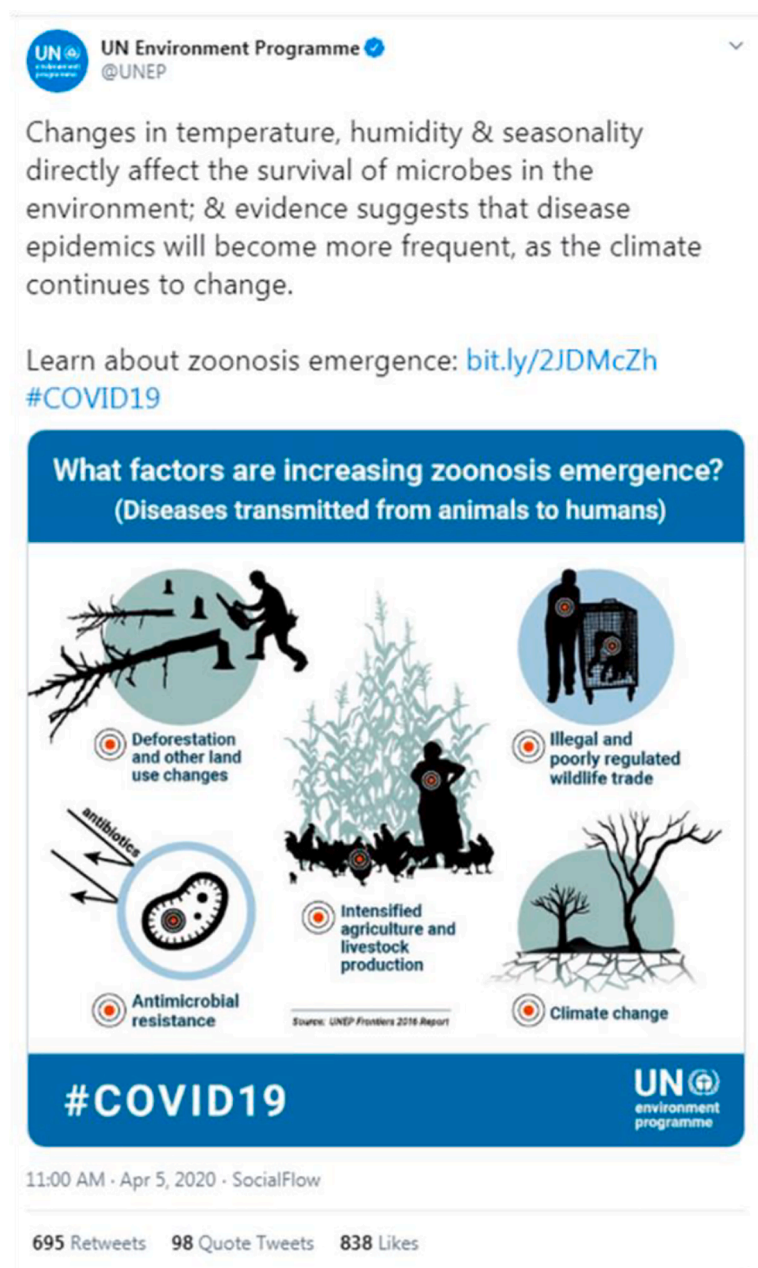


Fig. A1. UN environmental program tweet about the link between climate change and COVID-19.

Table A1
Confirmatory factor analysis: environmental beliefs.

Item	Ecocentric: belief in danger to ecosystems	Human resourcefulness	Anthropocentric: Human dominance over nature
If things continue on their present course, we will soon experience a major ecological catastrophe	0.787		
Humans are severely abusing the environment	0.659		
When humans interfere with nature, it often produces disastrous consequences	0.491		
The earth has plenty of natural resources if we just learn how to develop them		0.341	
Human ingenuity will insure that we do NOT make the earth unlivable		0.896	
Humans will eventually learn enough about how nature works to be able to control it			0.588
Humans have the right to modify the natural environment to suit their needs			0.512
Humans were meant to rule over the rest of nature			0.655
Composite reliability AVEs	0.693 0.436	0.645 0.460	0.675 0.346
Squared correlations among latent variables	Ecocentric	Resourcefulness	Anthropocentric
Ecocentric	1		
Resourcefulness	0.175	1	
Anthropocentric	0.263	0.279	1

Scale reliability (Alpha) = 0.775
 Goodness-of-fit measures: χ^2 [161] = 35.36, $P < 0.0001$, CFI= 0.965, TLI = 0.938 RMSEA = 0.061, SRMR = 0.0470. Seven items were removed from the estimation due to low factor loadings.

Table A2
Principal component analysis: pre-, and post-COVID-19 pro-environmental behavior.

	Pre-COVID-19		Post-COVID-19	
	Recycling	Consumption reduction	Recycling	Consumption reduction
Recycle batteries	0.451		0.429	
Recycle paper	0.514		0.443	
Recycle glass	0.466		0.536	
Recycle plastic	0.554		0.539	
Reduce electricity consumption		0.463		0.469
Reduce luxury consumption		0.559		0.605
		0.458		0.602

Table A2 (continued)

	Pre-COVID-19		Post-COVID-19	
	Recycling	Consumption reduction	Recycling	Consumption reduction
Reduce overseas travel				
Reduce food consumption		0.512		0.503
Eigen values	3.142	2.562	2.832	1.534
AVE	0.251	0.253	0.242	0.467
Squared correlations among latent variables				
Recycling and consumption reduction	0.079			0.112

Scale reliability (Alpha): Pre-COVID-19 = 0.853, Post-COVID-19 = 0.811

Table A3
Principal component analysis: taking climate change more seriously.

Item	Loadings
Because of the COVID-19 outbreak I am more concerned over climate change	0.440
Because of COVID-19 I take climate change predictions more seriously	0.475
Because of the COVID-19 outbreak I tend to accept scientists' evaluations that human actions have a significant effect on climate change	0.480
Because of COVID-19, I think governments need to take action to deal with climate change	0.457
Because of COVID-19 lifestyle changes should be promoted	0.373
Eigen value	3.335

Scale reliability (Alpha)= 0.875

Table A4
Principal component analysis: self-resilience.

Item	Loadings
I feel I can handle my problems well in the current period	0.702
I believe that my life will improve in the near future	0.701
Eigen value	1.445

Scale reliability (Alpha)= 0.627

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