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Visioning Sustainable Futures: Exposure to Positive Visions Increases Individual and Collective Intention to Act for a Decarbonated World

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Abstract

A key factor for behavioural change, when individuals are already concerned by environmental crises, is individuals' perception of how they could cope with such an issue in an effective way, as well as their perception of their ability to imagine environmental cognitive alternatives to the behavioural status quo. Is it possible to boost these perceptions through the presentation of positive visions of the future? In this experimental study (N = 300), we tested whether being exposed to positive visions of a decarbonated future influences individuals' perceived ability to imagine environmental cognitive alternatives as well as their efficacy beliefs, and their intention to engage in climate change mitigation behaviour at an individual and collective level. More precisely, we compared the effects of being exposed to a positive vision focused on either eco-sufficiency or eco-efficiency through green technologies, to achieve the decarbonated world described (including also a control condition). Results confirmed that, regardless of the focus of the positive vision, being exposed to a positive vision is sufficient to increase individuals' perceived ability to imagine the future, their perceived collective efficacy, and their intention to engage in individual pro-environmental consumption behaviours, technology-use behaviours, and collective behaviours. These findings explore and explain the psychological effects of mere exposure to positive visions

on socio-cognitive determinants of behavioural change, which could become an effective strategy to motivate pro-environmental behavioural change in communication and education campaigns.

Keywords

positive visions, individual intentions, collective intentions, environmental cognitive alternatives to the status quo, collective efficacy appraisal

Non-Technical Summary

Background

A key factor motivating people to engage in actions in favour of the environment is their perception of how they could cope with climate change in an effective way. This includes their perception of the possible costs and benefits of changing their current behaviours. Indeed, one of the barriers to pro-environmental action is individuals' inability to conceive the consequences of climate change: people need to feel that they can envisage the future in order for them to try and achieve this.

Why was this study done?

This study was done to test for the first time the effects of presenting to individuals with a positive vision of a decarbonated ecological future. More precisely, we expect that individuals who will read about such positive vision will feel more able to imagine the future, and will thus be more motivated to act for it.

What did the researchers do and find?

The data demonstrated that reading a positive vision about a decarbonated ecological society in 2050 increases participants' perception of their ability to imagine such a future, their perception of how effective it would be to adopt pro-environmental actions in order to achieve it, and their intention to do so.

What do these findings mean?

The results suggest that presenting a positive vision of what the future could be if we change is a key to increasing individuals' willingness to act pro-environmentally.

Highlights

- Exposure to a positive vision of a decarbonated ecological future society increases individual and collective intentions to engage in favour of the environment.
- The effects of a positive vision focused on eco-sufficiency are similar to the effects of a positive visions focused on eco-efficiency.
- Exposure to a positive vision of a decarbonated ecological future society increases individuals' perception of their ability to imagine environmental cognitive alternatives to the status quo, as well as collective efficacy appraisal.

Despite a growing awareness and engagement of individuals concerning climate change (Eurobarometer 501, European Commission, 2019; IPCC 2018), planetary limits and boundaries keep being surpassed by the lifestyle of developed countries. Climatic disruptions around the world cause record heat-waves, wildfires, droughts, ice loss and floods, which are expected to continue in coming decades as the effects of anthropogenic climate change intensify (Barnosky, 2005; Waters et al., 2022). Motivating citizens to adopt pro-environmental behaviours at an individual level, and to engage collectively for social and societal changes, is a real challenge that is being addressed by a growing body of research in social sciences (e.g., Barth et al., 2021; Fritsche & Masson, 2021). A key factor for behavioural change, when individuals are already sensitive and concerned about a specific issue such as climate change, is individuals' ability to imagine how they could cope with such an issue in an effective way, taking into consideration the possible costs and benefits of changing the status quo (Kothe et al., 2019; Steg & Nordlund, 2018). In the present paper, we argue that individuals' perception of their own ability to imagine an eco-responsible future world alternative to the status quo ("environmental cognitive alternatives"; Wright et al., 2020), as well as their efficacy beliefs and cost-benefits evaluations, could be positively influenced by presenting positive visions of a decarbonated future to individuals.

Visioning and Perceived Ability to Imagine Desirable Eco-Responsible Futures Alternative to the Status Quo

Positive visions can be described as desirable future states (Costanza, 2000; McPhearson et al., 2016) that can motivate actions and inspire innovative strategies to facilitate transitions (Bai et al., 2016). Heterogeneous processes and structures have been adopted for developing positive visions of an ecological future (e.g., Robinson et al., 2011; Veland et al., 2018); however, little work has been done to empirically test whether such positive visions motivate towards individual and collective action in favour of the environment.

Alternative concepts related to thinking positively about the future in general, such as optimistic thinking (e.g., Oettingen & Mayer, 2002) and utopian thinking (e.g., Fernando et al., 2018), or being able to adopt a future-oriented perspective in general

(Aspinwall, 2005) have been demonstrated to determine strong motivation and performance. Similarly, empirical work has demonstrated that, on the contrary, individuals' inability to conceive the consequences of climate change is one of the barriers to pro-environmental action (Norgaard, 2011; Schoemaker & Tetlock, 2012). Recently, the concept of *environmental cognitive alternatives* has been proposed in the field of environmental psychology to describe individuals' perception of their ability to imagine a future sustainable world alternative to the current world (Wright et al., 2020, 2022). This concept is based on the idea of "cognitive alternatives", originally introduced by Tajfel (1978) as the belief that ''the existing social reality is not the only possible one and that alternatives to it are conceivable and perhaps attainable'' (p. 93). Being able to conceive such alternatives is considered as a precursor of social change and innovation, as the possibility to envision a desirable alternative to an undesirable current state of things is what motivates towards trying to attain such a desirable alternative. In the field of pro-environmental behaviours, Wright and collaborators (2020, 2022) have shown that it is more likely that individuals engage in pro-environmental actions when they can clearly imagine how a sustainable world alternative to the status quo would look like.

We argue that such perceived ability can be triggered by presenting positive visions of decarbonated futures to individuals, and that individuals exposed to a positive vision of the future will also perceive pro-environmental actions as more effective (a dimension defined "perceived efficacy") and their adoption as less costly (a dimension defined "costs-benefits of changing the status quo") than individuals who are not presented with positive visions. Indeed, individuals' decision to engage in a specific behaviour when facing a threat is directly determined by their perception of such behaviour as being useful and effective in coping with the threat. This has been defined as "perceived efficacy" (Bosone et al., 2015; Witte & Allen, 2000), and specifically "perceived collective efficacy" when it comes to both individual and collective actions in favour of the environment. Collective efficacy is the individual's beliefs in the ability of his/her group (be that a general social group such as Human Kind, the inhabitants of the same region, or a more restrained social group) to meet desirable objectives (Bandura, 2000; Thaker et al., 2016; van Zomeren et al., 2008). Collective efficacy has demonstrated to be a strong predictor of individuals' intentions to engage in favour of the environment (Fritsche & Masson, 2021; Hornsey et al., 2021), together with the consideration of the costs of changing a specific behaviour, and the benefits of instead maintaining the current behavioural status quo (Kothe et al., 2019, 2023; Villamor et al., 2023). It is possible to suppose that collective efficacy would motivate to engaging in both collective and individual behaviours, as people's belief that they have personal influence over something as large-scale as climate change can be weak (Hornsey et al., 2021; also see climate change helplessness; Salomon et al., 2017), however the belief that collective effort is effective could still motivate to act (Jugert et al., 2016). Moreover, the perceived costs associated to changing a behaviour when facing a threat (i.e., "response-cost") and the

perceived benefits associated with maintaining the current behaviour (i.e., "maladaptive rewards") have been demonstrated to predict weak intention to adopt climate-change mitigation behaviours, such as reducing the use of carbon fuels (Kothe et al., 2023), as well as adaptive behaviours (Villamor et al., 2023). We argue that exposure to a positive vision highlighting the positive outcomes of pro-environmental changes to citizens' lifestyles will bring individuals to perceive such collective changes as effective and costless, and—parallelly—to perceive the maintenance of the current behavioural status quo as detrimental. We thus expect individuals exposed to a positive vision to report stronger environmental cognitive alternatives, higher perceived efficacy and better cost-benefits ratio, as well as stronger intention to engage in individual and collective actions in favour of the environment.

A few studies have demonstrated how imagining or envisioning a sustainable future society has a positive impact on individuals' efficacy beliefs (Hamann et al., 2021) as well as their intention to engage in actions to strive for such a future (Badaan et al., 2022; Bain et al., 2013; Fernando et al., 2020). For instance, in a study carried out by Fernando and colleagues (2020), participants were asked to either imagine a Green utopia, or a Sci-fi utopia, or the description of a general day in their life, and to formulate new sentences describing what they imagined. Data from the self-reported questionnaire that followed demonstrates that imagining a Green utopia generated higher motivation to engage in social changes in general (Study 1) and environmental citizenship specifically (Study 2) than imagining a Sci-fi utopia, as it increased perceived collective self-efficacy in general (Study 2). In a transdisciplinary study, Hamann et al. (2021) tested the effects of a peer-to-peer coaching program for sustainability volunteers, where participants to student-led sustainability initiatives where coached in envisioning a sustainable future (among other skills). Pre- and post-program measures demonstrated how participants' beliefs about their own efficacy (self-efficacy) and the effectiveness of their contribution to collective action (participative-efficacy) improved thanks to the programs. In both these examples, participants were asked not only to imagine a future, but also to describe it, thus participating actively in the envisioning process. What would happen if individuals were asked to imagine a detailed future society described in a positive vision to which they were exposed? In a research by Badaan et al., (2022), data demonstrated that reading a text about a utopian society (not related to environmental sustainability) elicited greater hope, and intentions to engage in collective actions for social change.

The main goal of the present research is to further investigate the specific effect of being exposed to positive visions about a decarbonated pro-environmental future society on individuals' intention to engage in favour of the environment. Individuals can act for climate change mitigation by changing their day-to-day consumption behaviours (such as choosing to buy seasonal products, or to re-use packaging, or to reduce the use of their car) but also by engaging in collective actions (such as participating in social gatherings, signing petitions). We argue that exposure to a positive vision will increase

individuals' intention to engage at both levels of pro-environmental action. Moreover, we argue that exposure to positive visions will not only increase behavioural intentions, but also individuals' perceived ability to imagine *environmental cognitive alternatives* to the status quo, their efficacy beliefs and perceived costs-benefits of such alternatives as well as the perceived plausibility and desirability of a decarbonated future.

Furthermore, we argue that the effect of exposure to a positive vision will vary depending on the focus of such vision, on either eco-sufficiency or eco-efficiency through green technologies. "Eco-sufficiency" refers to individual and collective efforts to change consumption habits and lifestyle in general, aiming at an absolute reduction of the volume of consumption (Figge et al., 2014). It includes absolute reduction of unsustainable behaviours, modal shifts, product longevity and sharing practices (for a review see Sandberg, 2021). "Eco-efficiency" on the other hand refers to the development and use of green technologies to reduce the amount of resources used in, and the emissions caused by, the production, distribution and use/consumption of products, while providing the same service (Figge et al., 2014; Heikkurinen et al., 2019). Schematically, eco-efficiency does not imply a fundamental change in citizens' lifestyles. The role of green technologies in the ecological transition is of particular interest, as it could actually become a barrier to individual change. Indeed, one of the barriers to pro-environmental behaviours has been identified in the "external attribution" of responsibility (Bosone et al., 2022): the belief that someone else, the government as well as scientists and new technologies, have the responsibility and the possibility to mitigate climate change. In particular, beliefs in salvation thanks to new technology and science (also defined as "techno-salvation"; Droege, 2002; Gifford, 2011) can be an important partner in mitigating climate change (e.g., Gifford, 2008; Terwel et al., 2009), and people who share this belief can consider new green technologies as a solution that, alone, can solve the problems associated with climate change (Lorenzoni et al., 2007). Such overconfident belief, also defined as "techno-salvation", can become a barrier to their own climate-mitigating behaviour (Gifford, 2011; Lacroix et al., 2019). To better illustrate with an example, a positive vision based on eco-sufficiency would describe how individuals reduce the heating in their house (either by reducing the temperature, or the period when the heating is on), while a positive vision based on eco-efficiency would describe how individuals use heat pumps instead of wood or electricity to heat their house.

We thus decided not only to test the influence of exposing vs. not-exposing individuals to a positive vision of decarbonated future, but also whether this differs depending on the focus of such vision on "eco-sufficiency" or "eco-efficiency through green technologies". The secondary goal of this research is thus to investigate whether the content of a positive vision modulates its effects on behavioural intentions. More precisely, we will measure two types of individual intentions: consumption intentions (such as buying seasonal products and using the car less) as well as technology-use intentions (such as keeping trace of the environmental impact of their actions thanks to connected objects),

expecting that exposure to both positive visions will increase consumption intentions, but that technology-use intentions will be increased rather by the vision concerning the importance of new technologies for achieving eco-efficiency.

Finally, we propose to test the effects of two types of pre-existing beliefs as moderators of the effects of being exposed to a positive vision (as explained in the following section): individuals' perception of climate change psychological distance (Spence et al., 2012), as well as their perception of themselves as pro-environmental individuals (pro-environmental self-identity; Whitmarsh & O'Neill, 2010).

The Moderating Effect of Psychological Distance and Pro-Environmental Self-Identity

Climate change psychological distance refers to individuals' perception of the proximity of the consequences of climate change on four dimensions: geographical (referring to the spatial distance between the event/object and the perceiver), temporal (referring to the time between the object/event and the perceiver), social (referring to whether a phenomenon concerns people that are similar to the perceived), and certainty (referring to the perceived likelihood of the event) (Bosone et al., 2022; Spence et al., 2012). Greater perceived psychological distance from a threat can lead to inaction. If individuals do not feel concerned about a threat, they are not interested in searching for a behavioural alternative to face it. Research in developed countries has found that people's perception of the psychological distance of climate change is high and that it will likely impact people and places that are geographically and socially distant (Leiserowitz et al., 2009; Spence & Pidgeon, 2010), and that this can reduce individuals' concern about it and motivation to act to mitigate it (for a review, see Maiella et al., 2020). As such, it is possible to suppose that perceived psychological distance will moderate the effects of presenting positive visions to individuals, as individuals who perceive climate change as a distant threat are expected to be less concerned by it and less interested in a decarbonated future society. Hence, individuals who perceive climate change as a distant threat are expected to be less sensitive to the exposure to positive visions than individuals who perceive climate change as a close threat, reporting weak behavioural intentions regardless of whether they have been exposed to a positive vision.

Psychological distance is not the only variable that could moderate the effects of positive visions. Individuals' perception of themselves as pro-environmental individuals could also influence such effects. Self-identity is the way individuals perceive themselves, the way they see themselves, and an environmental self-identity refers to "the extent to which one sees oneself as a type of person whose actions are environmentally-friendly" (van der Werff et al., 2013), and it has been demonstrated as a valid predictor of environmental behaviours (for a review, see Vesely et al., 2021). Research has demonstrated that a strong environmental self-identity is associated to stronger pro-environmental intentions (Carfora et al., 2017; Whitmarsh & O'Neill, 2010), because people seek consis-

tency between their identity and beliefs and their behaviours and tend to act in line with how they see themselves. Therefore, the more they see themselves as environmentally friendly persons, the more they are concerned with pro-environmental behaviours and the more they are motivated to adopt them (Gatersleben et al., 2014; van der Werff et al., 2013; Wang et al., 2021). As such, it is possible to suppose that individuals with strong pro-environmental self-identity will be strongly motivated to engage in pro-environmental behaviours regardless of whether or not they are presented with a positive vision about a decarbonated future. We thus expect individuals who already perceive themselves as pro-environmental consumers to report stronger behavioural intentions than individuals who have a weaker environmental self-identity, regardless of whether they have been exposed to positive visions of the future.

Overall Objectives

The main goal of the experimental study presented in this paper is to test whether exposing individuals to a positive vision of a decarbonated future influences their intention to engage in pro-environmental behaviours at an individual and collective level, as well as individuals' perceived ability to imagine *environmental cognitive alternatives* to the status quo, efficacy beliefs and perceived costs-benefits of such alternatives. The secondary goal of this research is to investigate whether the content of a positive vision, on either eco-sufficiency or eco-efficiency through green technologies, modulates its effects on behavioural intentions. Finally, the present research also aimed to verify whether the effects of exposing individuals to a positive vision (being that focused on eco-sufficiency or eco-efficiency) is moderated by individuals' perception of the psychological distance of climate change, as well as their environmental self-identity.

Pre-Test

Two visions were developed based on two scenarios developed by ADEME (Agency for the Ecological Transition in France) in the Transitions 2050 project. Scenario 1, "Frugal generation", inspired the creation of the positive vision focused on "eco-sufficiency" (ES), whereas Scenario 3, "Green technologies", inspired the creation of the positive vision focused on "eco-efficiency through green technologies" (EEGT). The full texts of the scenarios are available on the ADEME's website, and the English version of the positive visions is reported in Bosone et al. (2024). The original positive visions counted around 370 words, and both talked of a 2050 society, describing accommodation, travel habits, production processes and job offer, citizens' consumption. The positive visions in the original language are available by contacting the corresponding author.

Method

The two visions were pre-tested on a convenience sample of 60 French individuals (61% men and 39% women, aged from 20 to 69, M = 32.03, SD = 10.41; data collected via the Prolific platform), to test whether the visions were clear, understandable, interesting, and represented concretely vs. abstractly a decarbonated future and what to do to accomplish it (ratings on a 7-point Likert scale from 1—Not at all, to 7—Completely), and whether they were perceived as focusing on citizens' efforts or the impact of new technologies in favour of the environment (manipulation check to test the understanding of the eco-sufficiency vs. eco-efficiency focus). More precisely, individuals were asked to rate their agreement (on a 7-point Likert scale from 1—Not at all, to 7—Completely) on two items checking the understanding of the eco-sufficiency positive vision ("The focus of this text is on how citizens can contribute to a future decarbonated society", "This message explains how individuals can change their lifestyle to achieve an ecological future based on a fundamental change in consumption habits"; Spearman's rho = .79, p < .001), and two items checking the understanding of the eco-efficiency vision ("The focus of this text is on how new technologies can contribute to a future decarbonated society" and "This message explains how new technology is the key to use resources more efficiently"; Spearman's rho = .73, p < .001).

Results

Student t-tests for independent samples were carried out to analyse whether the focus of each scenario was clear, and whether the perception individuals had of the scenarios as well as the future world represented in each one of them varied depending on the type of scenario. Results demonstrated that indeed participants exposed to the ES positive vision perceived it as more focused on eco-sufficiency efforts (composite score; M = 5.47, SD = 1.23) and less focused on the role of green technology (composite score; M = 3.78, SD = 1.48) than participants exposed to the EEGT positive vision, sufficiency efforts: M = 4.63, SD = 1.61; $t(1,61)$ = 2.28, p = .03, 95% CI [.11; 1.57]; green technology role: M = 5.41, SD = 1.43; $t(1, 61)$ = -4.35, p < .001, 95% CI [-2.37, -.87]. Interestingly, the perception of the scenario and the future world presented in it did not vary depending on the focus of the scenario (all means and standard deviations, as well as t and p values, are reported in Table 1).

Key Findings of Pre-Test

The pre-test of the two scenarios show that while the focus of each scenario is correctly identified as either on eco-sufficiency efforts or on eco-efficiency through green technologies for the ecological transition, the perception of the scenarios in terms of their clarity and plausibility does not vary, as expected. They will thus be used as the two positive

Table 1

Evaluation of the Positive Visions (Pre-Test): Means, Standard Deviation and t-Tests

	ES positive vision	EEGT positive vision			
The text you just read…	***M (SD)***	***M (SD)***	***t*(1,61)**	***p***	**Cohen's *d***
…is clear.	5.97 (1.16)	5.65 (1.31)	1.02	.32	.26
…is understandable.	6.13 (1.41)	5.97 (1.05)	0.52	.61	.13
…is interesting.	5.67 (1.54)	5.26 (1.46)	1.06	.29	.27
…is based on reality.	3.87 (1.57)	4.26 (1.37)	- 1.04	.31	.26
…is based on scientific data.	4.21 (1.41)	4.29 (1.35)	- 0.26	.79	.06
…presents a likely future.	4.01 (1.41)	4.48 (1.41)	- 1.34	.19	.33
…presents a plausible future.	3.97 (1.59)	4.61 (1.51)	- 1.64	.11	.41
…presents the future in a concrete way.	5.23 (1.61)	5.06 (1.48)	0.43	.67	.11

visions in the experimental study in order to analyse the effects of being exposed to a positive vision.

Experimental Study

Method

Experimental Design and Procedure

To answer to our research questions, we carried out an experimental study following a three-levels between-subjects design. Individuals were equally and randomly assigned to either one of the following conditions (varying the levels of the independent variable, namely "Exposure to Positive Visions"):

- ES condition: individuals received the positive vision focused on eco-sufficiency (the same used in the pre-test, see Bosone et al., 2024).
- EEGT condition": individuals received the positive vision focused on eco-efficiency through green technologies (the same used in the pre-test, see Bosone et al., 2024).
- Control condition: individuals did not read any text.

Participants in the ES condition and in the EEGT condition were asked at first to fill-in measures of the moderating variables (psychological distance of climate change and pro-environmental self-identity; the order of presentation of the items was randomised), then to read the text in the two experimental conditions, and finally to answer a questionnaire measuring the dependent variables as explained below (all measures are reported in Bosone et al., 2024). Participants in the control condition also answered to the moderating variables first (order of presentation randomised) and then to the questionnaire measuring the dependent variables. Participants were recruited between September

2022 and October 2022 on the "IPSOS Observer platform". Since no previous work has analysed the influence of exposure to scenarios about future worlds on behavioural intentions, we followed Jackson's (2003) recommendations: 20 participants per estimated parameter on which we aim to test the influence of exposure to a scenario (20*5 = at least 100 participants in each experimental condition; further details in the pre-registration "Imagining the Future" (Bosone & Thiriot, 2023). Data collection and analysis have been carried out in agreement with the European General Data Protection Regulation (GDPR). Data is openly available (Bosone et al., 2023).

Participants

300 individuals living in France participated in the study, 18 to 60 years old (M = 29.66, SD = 8.18), 49.7% men and 50.3% women. As for their education level, 32.3% of the participants finished high school or correspondent, 15% obtained a university diploma (shorter than Bachelor's degree), 21% a Bachelor's degree, 29.3% a Master's degree, and 2.3% a PhD.

Moderating Variables

Before exposure to positive visions in the experimental conditions, individuals were asked to respond to three questions to measure their perception of the *psychological distance of climate change* (inspired by Spence et al., 2012; e.g., "The negative effects of climate change are more likely to impact people that are not like me"; $\alpha(N = 3) = .83$; the composite dimension was reversed, so that higher ratings correspond to psychological proximity, and lower ratings to high psychological distance) and two items measuring their *environmental self-identity* (inspired by Whitmarsh & O'Neill, 2010; e.g., "Acting environmentally-friendly is an important part of who I am", Spearman's rho = .66, $p < .001$).

Dependent Variables

Perceived Ability to Imagine Environmental Cognitive Alternatives to the Status Quo — To measure individuals' perceived ability to imagine a sustainable future, we asked participants to rate their agreement with six items; $\alpha(N = 6) = .87$; e.g., "I can think of several ways to achieve a world where carbon emissions would be reduced to a minimum", on a scale from 1—Completely disagree, to 7—Completely agree. We used the six most general items from the Environmental Cognitive Alternative scale (by Wright et al., 2020). The items were computed in one dimension which we will refer to as "Imagining ECA".

Collective Efficacy and Perceived Costs-Benefits of the Status Quo — Collective efficacy was measured by asking individuals to rate their agreement, on a scale from 1—Completely disagree, to 7—Completely agree, with two items inspired by Bamberg et

al. (2015), such as "Together, we can effectively fight against climate change" (Spearman's rho = .65, $p < .001$). Perceived costs-benefits were measured through four items constructed ad hoc for this study, e.g., "It is important to maintain the advantages of our current lifestyle despite its negative effects for the environment"; $\alpha(N = 4) = .79$.

Perception of a Decarbonated Future: Desirability, Feasibility, Plausibility — Perceived desirability of the decarbonated future presented in the visions (or "a" decarbonated future for individuals in the control condition) was assessed through four items, e.g., "I would gladly live in a decarbonated society"; $\alpha(N = 4) = .87$. Perceived feasibility was assessed through two items measuring whether individuals perceived citizens to be able to change lifestyle in order to achieve a decarbonated future world (e.g., "It will be easy for all citizens to change their current lifestyle in order to achieve a decarbonated society"; Spearman's rho = .31, $p < .001$). Perceived plausibility was assessed through two items measuring whether individuals perceived it to be plausible to achieve a decarbonated world in the next decades (e.g., "It is likely that in 2050 we live in a decarbonated society"; Spearman's rho = .39, $p < .001$). All items asked individuals to rate their agreement on a scale from 1—Completely disagree, to 7—Completely agree.

Behavioural Intentions — Participants were asked to rate their intention to engage in 25 different individual and collective behaviours in favour of the environment, on a scale from 1—Not at all, to 7—Completely. Items were either inspired by past work (e.g., Bamberg et al., 2015; Bosone & Bertoldo, 2022) or created ad hoc for this study, in order to measure individual pro-environmental intentions, $\alpha(N = 14) = .92$, technology-use intentions, $\alpha(N = 3) = .76$, and collective intentions, $\alpha(N = 6) = .89$. The items are reported in Table 2. A confirmatory factor analysis validated a three-factors model yielded good and acceptable fit indices: $\chi^2(227) = 827.8$, $p < .001$, CFI = 0.985, TLI = 0.983, RMSEA = 0.09, SRMR = 0.07 (two items were however eliminated from the sample because of cross-loadings; see Table 2). We then created three composite scores of behavioural intentions: Individual Intentions, Collective Intentions and Technology-use intentions.

Results

Analysis Plan

A MANOVA was carried out in order to test the effects of being exposed to an ES positive vision vs. an EEGT positive vision vs. No positive vision (control) on behavioural intentions as well as individuals' perceived ability to imagine environmental cognitive alternatives to the status quo, collective efficacy and perceived costs-benefits, as well as the desirability, feasibility and plausibility of a decarbonated future. All F and p values are reported in Table 3, while Means and Standard Deviations for each group are reported in Table 4. When the test was significant, further Tukey t-tests were carried out. Further, moderation analyses (reported in Table 5) were carried out using the MedMod

Table 2

Behavioural Intention Items (CFA; Experimental Study)

Factor 1—Individual intentions
Buying seasonal products.
Working from home (or smart working) more often to reduce daily trips.
Buying discounted food that is soon expiring from the grocery stores.
Reusing some packaging materials (e.g., plastic boxes, glass bottles and jars) for the same purpose or invent new uses for them.
Buying food from local producers to reduce the numbers of intermediaries.
Using materials from my kitchen, such as vinegar or baking soda, as cleaning detergents.
Being attentive to nature while gardening.
Growing some of the vegetables (or herbs) I use myself.
Buying in bulk to reduce the amount of packaging waste.
Reducing the use of your own car for short trips.
Keeping informed about current developments regarding climate change.
Buying more organic food.
Planning holidays close to home, or to a location reachable by train.
Reducing your own meat consumption.
Factor 2—Collective intentions
Being part of a group of people to share tools and appliances (such as lawnmowers, washing machines, cars, kitchen tools…).
Publicly campaigning (e.g. via petitions, demonstrations) for pro-environmental policies.
Participating actively in a nature conservation organization in order to help conserve nature.
Renting gardening and do-it-yourself tools instead of buying new ones.
Using car-sharing services instead of your own car.
Drawing the attention of your friends and acquaintances to climate change.
Factor 3—Technology-use Intentions
Keeping trace of the environmental impact of your actions thanks to connected objects.
Using connected objects to keep track of your consumption habits.
Buying an electric car.
Items eliminated
Freezing some of the food to reduce food waste, if I don't need it right away.
Making some of my cosmetics (e.g., deodorant).

function in Jamovi, in order to analyse the moderating effect of psychological distance and self-identity on the effect of exposure (vs. non-exposure) to a positive vision on the three levels of behavioural intentions (individual consumption, individual technology use, and collective).[1] Table 7 in Bosone et al. (2024) presents the correlations among studied variables across the total sample, and Table 8 (also in Bosone et al., 2024) presents

Table 3

MANOVA Analysing the Effects of Exposure to Positive Visions

IV	*DV*	*F*	*p*	η_p^2
Exposure to Positive Visions	Individual Intentions	20.27	< .001	.12
	Collective Intentions	9.73	< .001	.06
	Technology-use Intentions	6.69	.001	.04
	Imagining ECA	24.78	< .001	.14
	Collective Efficacy	13.04	< .001	.08
	Costs-Benefits	0.82	.44	.005
	Desirability	12.93	< .001	.08
	Plausibility	2.33	.09	.02
	Feasibility	4.06	.02	.03

all means and standard deviations for all studied variables, across the total sample as well as specifically for each experimental group.

The Influence of Exposure to Positive Visions

On Behavioural Intentions — Exposure to positive visions had a significant effect on all three dimensions of behavioural intentions. Tukey *t* post-hoc tests demonstrate that individuals in the Control condition reported weaker intentions on all dimensions than individuals in the ES condition (on Individual Intentions: Tukey $p < .001$; on Collective Intentions: Tukey $p < .001$; on Technology-use Intentions; Tukey $p = .003$) and in the EEGT condition (on Individual Intentions: Tukey $p < .001$; on Collective Intentions: Tukey $p = .001$; on Technology-use Intentions; Tukey $p = .008$). However, no significant difference was found in the intentions reported by individuals in the ES vs. EEGT conditions (on Individual Intentions: Tukey $p = .76$; on Collective Intentions: Tukey $p = .93$; on Technology-use Intentions; Tukey $p = .96$).

On Environmental Cognitive Alternatives and Collective Efficacy — Exposure to positive visions had a significant effect on both individuals' perceived ability to imagine

1) It is important to flag this as a deviation from the pre-registered analysis plan. Indeed, we pre-registered a statistical plan based on a MANCOVA analysis of the effects of being exposed to positive visions on all dimensions while controlling for the moderating influence of psychological distance and environmental self-identity as co-variates. However, after the first round of revision, and considering that the effects of being exposed to the two types of positive vision do not differ, we feel like proper moderation analyses (comparing being exposed to a positive visions vs. control group) are better suited to pursue the aims of the study. We thus carried out a simple MANOVA comparing the means and standard deviations for individuals in each experimental condition, and then moderation analyses. For the sake of transparency, we report the original MANCOVA in Bosone et al. (2024), Table 6.

Table 4

Means and Standard Deviations Across Experimental Groups (Experimental Study)

	Control	ES condition	EEGT condition
Dependent Variables	***M (SD)***	***M (SD)***	***M (SD)***
Individual Intentions	4.31 (1.46)	5.28 (1.01)	5.16 (1.03)
Collective Intentions	3.51 (1.35)	4.36 (1.66)	4.28 (1.52)
Technology-use Intentions	3.66 (1.45)	4.37 (1.52)	4.31 (1.63)
Imagining ECA	3.88 (1.16)	4.84 (1.15)	4.94 (1.21)
Collective Efficacy	4.25 (1.55)	4.92 (1.29)	5.25 (1.33)
Costs/Benefits	4.25 (.97)	4.46 (1.29)	4.35 (1.21)
Desirability	3.81 (1.49)	4.75 (1.46)	4.71 (1.48)
Plausibility	3.86 (1.25)	4.04 (1.62)	4.29 (1.34)
Feasibility	3.98 (1.05)	4.35 (1.41)	4.45 (1.25)

Note. All answers were given on a 7-point scale (min. 1 and max. 7).

environmental cognitive alternatives and their perception of collective efficacy. Tukey *t* post-hoc tests demonstrate that individuals in the Control condition reported weaker perceived ability to imagine environmental cognitive alternatives to the status quo than individuals in the ES condition (Tukey $p < .001$) and in the EEGT condition (Tukey $p < .001$). However, no significant difference was found when comparing individuals in the ES vs. EEGT conditions (Tukey $p = .74$). Similarly, individuals in the Control condition reported weaker collective efficacy than individuals in the ES condition (Tukey $p < .001$), and in the EEGT condition (Tukey $p < .001$). However, no significant difference was found when comparing individuals in the ES vs. EEGT conditions (Tukey $p = .14$).

On Desirability, Plausibility and Feasibility — Exposure to positive visions had a significant effect on perceived desirability and feasibility, but not perceived plausibility, of the positive vision. Tukey *t* post-hoc tests carried out on individuals' ratings of desirability showed the same patterns as the previously detailed effects: individuals in the Control condition reported lower desirability than individuals in the ES condition (Tukey $p < .001$) and in the EEGT condition (Tukey $p < .001$). However, no significant difference was found when comparing individuals in the ES vs. EEGT conditions (Tukey $p = .99$). The results are slightly different when considering the dimensions of perceived feasibility. Indeed, individuals in the Control condition reported lower perceived feasibility than in the EEGT condition (Tukey $p = .02$), however no other significant difference was identified between groups (all Tukey *ns*).

Table 5

Simple Moderation Models

Model	Fixed factors	B	*p*	95% CI
Model 1 (on Individual Intentions)	Exposure	.97	.001	[.71, 1.31]
	Psychological Distance	.35	.001	[.24, .47]
	Exposure × Psychological distance	.63	.001	[.33, .94]
Model 2 (on Collective Intentions)	Exposure	.93	.001	[.55, 1.29]
	Psychological Distance	.37	.001	[.21, .53]
	Exposure × Psychological distance	.44	.01	[.06, .75]
Model 3 (on Technology-use Intentions)	Exposure	.78	.001	[.43, 1.17]
	Psychological Distance	.26	.001	[.11, .43]
	Exposure × Psychological distance	.18	.29	[-.13, .55]
Model 4 (on Individual Intentions)	Exposure	.93	.001	[.57, 1.29]
	Environmental Self-Identity	.35	.001	[.22, .45]
	Exposure × Environmental Self-Identity	.59	.001	[.25, .88]
Model 5 (on Collective Intentions)	Exposure	.85	.001	[.55, 1.14]
	Environmental Self-Identity	.50	.001	[.36, .64]
	Exposure × Environmental Self-Identity	.51	.001	[.19, .79]
Model 6 (on Technology-use Intentions)	Exposure	.71	.001	[.35, 1.06]
	Environmental Self-Identity	.32	.001	[.17, .47]
	Exposure × Environmental Self-Identity	.41	.013	[.07, .73]

Moderation of the Effect of Exposure on Behavioural Intentions by Psychological Distance and Environmental Self-Identity

In order to test the moderating effects of psychological distance and environmental self-identity, we carried out six simple moderation models with a 500-sample bootstrap using the MedMod function of Jamovi. Considering that the effects of the exposure to an ET positive vision on behavioural intentions do not differ significantly from the effects of the exposure to an EEGT positive vision, we recoded the independent variable as a dichotomic variable for the purposes of the moderation analysis, checking the effect of exposure (coded as +1) vs. non-exposure (coded as -1) to a positive vision as the predictor.

Three models tested the moderating effect of Psychological Distance (higher levels indicating psychological proximity, and lower levels indicating psychological distance) on the influence of Exposure on Individual Intentions (Model 1), Collective Intentions (Model 2) and Technology-use Intentions (Model 3). Three models tested the moderating effect of Environmental Self-Identity on the influence of Exposure on Individual Inten-

tions (Model 4), Collective Intentions (Model 5) and Technology-use Intentions (Model 6). All β and p values, as well as confidence intervals, are reported in Table 5. Simple slope analyses were carried out when the moderation resulted significant, in order to better understand the interactive effect. Simple slope plots are reported in Bosone et al. (2024).

Psychological distance moderated the effect of Exposure on Individual Intentions (Model 1) and on Collective Intentions (Model 2). The decomposition of this interaction shows that the effect of Exposure on Individual Intentions increased with psychological proximity: the impact of Exposure is not significant when the psychological distance rating was lowest (indicating psychological distance; Individual: *M-1SD*; B = .24, *p* = .36; Collective: *M-1SD*; B = .41, *p* = .19), and became significant at moderate ratings of psychological distance (Individual: *M*; B = .98, *p* = .001; Collective: *M*; B = .93, *p* = .001) and at highest ratings of psychological distance (indicating psychological proximity; Individual: *M+1SD*; B = 1.74, *p* = .001; Collective: *M+1SD*; B = 1.45, *p* = .001). Psychological distance did not moderate the effect of Exposure on Technology-use Intentions (Model 3).

Environmental Self-Identity moderated the effect of Exposure on Individual Intentions (Model 4) as well as Collective Intentions (Model 5) and Technology-use Intentions (Model 6). The decomposition of this interaction shows that the effect of Exposure increased with environmental self-identity: the impact of Exposure was not significant when self-identity was lowest (Individual: *M-1SD*; B = .24, *p* = .28; Collective: *M-1SD*; B = .25, *p* = .34; Technology-use: *M-1SD*; B = .22, *p* = .36), and became significant at moderate levels of self-identity (Individual: *M*; B = .93, *p* = .001; Collective: *M*; B = .85, *p* = .001; Technology-use: *M*; B = .71, *p* = .001) and at highest levels (Individual: *M+1SD*; B = 1.63, *p* = .001; Collective: *M+1SD*; B = 1.45, *p* = .001; Technology-use: *M+1SD*; B = 1.19, *p* = .001).

General Discussion

The aim of the research presented in this paper was to offer empirical data analysing the influence of presenting a positive vision on the intention of citizens to engage individually and collectively in favour of the environment. Furthermore, we analysed how exposure to positive visions of the future also influences individuals' perceived ability to imagine environmental cognitive alternatives to the status quo, as well as perceived efficacy and costs-benefits linked to maintaining vs. changing the current behavioural status quo. Present findings are among the first findings on the influence of exposure to positive visions of decarbonated and eco-friendly future scenarios. They complement the findings by Fernando et al. (2020) and by Badaan et al. (2022), by confirming the positive effect that exposure to positive visions of a decarbonated future has on individual and collective behavioural intentions, and by its effects on individuals' perceived ability to imagine environmental cognitive alternatives to the status quo and perceived collective efficacy. Collective efficacy is however only one facet of individuals' efficacy beliefs;

recent studies have demonstrated that another important efficacy dimension influencing individuals' eco-friendly behaviours is participative efficacy (e.g., individuals' perception of the effectiveness of their own contribution to collective environmental effort; Hamann & Reese, 2020; Hamann et al., 2024). Based on present findings, further studies could focus on whether different efficacy beliefs, such as collective, participative, and self-related, could be directly boosted by exposure to positive visions of a decarbonated future.

Moreover, present findings also demonstrate that the effects of being exposed to positive visions of a decarbonated eco-responsible future are moderated by individuals' environmental self-identity or perception of climate change psychological distance. More precisely, the effect of exposure to a positive vision seems to increase the more climate change is perceived as a close threat, and the stronger environmental self-identity is. These results are in line with past findings demonstrating that both pro-environmental self-identity (e.g., Whitmarsh & O'Neill, 2010) and the perceived psychological distance of a specific environmental threat (e.g., Bosone & Bertoldo, 2022) are two strong predictors of the intention to act pro-environmentally. They are however the first results suggesting that these two dimensions would render individuals more or less sensitive to communication or education messages concerning the future, which would be an important information to guide communication and education campaigns. Further research is needed to understand if this is due to the fact that these two dimensions heighten a general sensibility to environmental issues or rather a tendency and ability to imagine the future.

Unexpectedly, exposure to positive visions did not have a significant impact on individuals' perception of the costs of changing the status quo, or the benefits of maintaining it. This could be explained by considering the first methodological limitation of the present study, which is that the costs-benefits evaluation measures are rather general. Indeed, the dimension measured by the present research could be considered as a general perception of the perceived utility of current behaviours, closer to individuals' values such as openness to change (i.e., the tendency of individuals to be ready to accept new ideas and actions) vs. conservation (the tendency of individuals to avoid changes; Schwartz et al., 2012). Future research should investigate further the specific perceived benefits of the current unsustainable society, and the perceived costs of a decarbonated future society.

Another surprising result concerns the fact that the effects of exposure to a positive vision does not vary depending on its focus: no differences were found between individuals presented with a positive vision focused on eco-sufficiency or on eco-efficiency. This could signify that exposure to any kind of positive vision is effective in influencing individuals' perception of their ability to imagine the future in general. Present findings do not allow to verify this, as individuals in the control condition were not exposed to any positive vision. Due to this second methodological limitation, it is not possible to conclude whether the effects of positive visions on individuals' intentions, efficacy

beliefs and perceived ability, are due to the exposure to a specific positive vision of future decarbonated worlds, or to the mere fact of being exposed to a positive vision in general. Further research is needed to confirm whether it is important to expose individuals to positive visions of decarbonated future societies, or whether any kind of positive future will do, to promote eco-friendly behavioural change.

One difference in the effects of the two positive visions concerns perceived feasibility. Indeed, only individuals exposed to the EEGT vision report higher rates of perceived feasibility than individuals in the control condition, which could suggest that people are willing to believe that science and new technology could "fix" climate change (Lorenzoni et al., 2007). In a recent Eurobarometer (European Commission Directorate-General for Communication, 2022) concerning Europeans' attitudes towards science and technology, data showed that 9 in 10 citizens think that the influence of science and technology is positive, especially in the fight against climate change. Further research should thus explore whether individuals' beliefs on new technology being solutions to environmental crises influences their perception of the feasibility of future decarbonated societies.

It is also important to consider that the experimental study measured classic pro-environmental intentions (such as consuming seasonal products) mixed with sufficiency-focused intentions (such as reducing the use of private cars and collaborative consumption). While past research has proposed different categories of pro-environmental behaviours, such as individual *versus* collective (e.g., Ando et al., 2010; Stern, 2000) or private *versus* public (e.g., Hamann & Reese, 2020), little is known about the possible differences in psychological levers to sufficiency- *versus* efficiency-focused behaviours. Future studies should investigate further whether and why individuals' understanding and motivation to engage in sufficiency- and efficiency-focused behaviours differ.

A further limitation to the generalisation of present findings concerns the fact that the study does not measure individual differences that could moderate the effects of exposure to positive visions, such education and socio-economic status (e.g., Lavelle et al., 2015; Meyer, 2015). Indeed, socio-economic status directly impacts individuals' predisposition towards time, meaning their tendency to be concerned about the past, present or future (Wagner et al., 2022; Zimbardo & Boyd, 2015). A future-oriented predisposition has been demonstrated to be associated with pro-environmental behaviours, characterised by short-term costs and long-term benefits (e.g., Yorkovsky & Zysberg, 2021). A future-oriented individual is more concerned by long-term costs and benefits, which could boost their ability to imagine future positive scenarios, whereas a present-oriented individual is more concerned by short-term costs and benefits, which could limit such ability. In the past, it has been demonstrated that being in a situation of socio-economic precarity is likely to focus individuals' attention on the present, and on short term benefits (i.e., a present time orientation; Adams & White, 2009; Fieulaine & Martinez, 2010; Wagner et al., 2022). The positive effects of exposing citizens to positive visions of the future could thus be moderated by their time perspective and their socio-econom-

ic status. Future research should thus investigate the effects of exposure to positive visions on a larger sample representing the various socio-economic status. On a related note, the generalisation of present findings is also limited by the fact that our samples were diverse in terms of individuals' gender and age, but not in terms of ethnicity or socio-cultural background. Considering past research demonstrating that cultural values can influence environmental concern and behaviours (e.g., Chwialkowska et al., 2020), further investigation is needed to confirm present data on a more globally diverse sample of respondents.

A final methodological limitation of this study concerns the self-reported measures of pro-environmental intentions. Indeed, although intentions are the strongest predictors of behavioural change (Ajzen, 1991), there is empirical evidence concerning the existence of an intention-behaviour gap (e.g., Grimmer & Miles, 2017): individuals with strong intentions to act in favour of the environment do not always change their behaviours in reality. Future research should thus analyse how exposure to positive visions can influence actual pro-environmental behaviour.

One question that remains unanswered is: are positive visions better than negative ones to promote behavioural change? Vast literature on persuasive communication in the health-promotion domain has demonstrated that negative framing ("loss-framing") is more effective in promoting behavioural change when facing possible risks (e.g., Homar & Cvelbar, 2021; Rothman & Kiviniemi, 1999). However, research has also demonstrated that when a negative message triggers intense fear, this can have a boomerang effect, as individuals will engage in denial mechanisms in order to control the fear rather than the threat (for a review see Ruiter et al., 2014). It is possible to suppose that dystopic scenarios of the future, presenting a negative vision of what the world will look like if the current lifestyle is not changed, would be less effective than presenting utopic scenarios (positive visions), for it is more difficult to imagine a dystopic future that triggers an intense level of fear and denial. Future research should thus compare the effects of presenting a positive "utopic" vision *versus* a negative "dystopic" vision, in order to corroborate present findings on the effectiveness of exposure to positive visions.

This research also presents important applied implications, especially considering the growing attention to the development of scenarios of the future that is characterising many environmental and ecological associations across the world. As well explained by Saujot and Waisman (2020), imagining the future allows societies to prepare today to technical, social and societal changes that require time to be implemented. The creation of a scenario integrating data from different scientific domains that can be shared among different stakeholders (including citizens) is fundamental for coordination and anticipation in the sustainable transition, in order to familiarise with the transformations and changes that are needed for an efficient transition. More importantly, present findings show how presenting positive visions of a sustainable future to individuals could be an effective strategy to promote awareness and behavioural change, offering potential use-

ful insights for communication and education campaigns. Positive visions can thus be a tool for collective education, to prepare the population, representing concretely plausible outcomes of an uncertain future, improving their perceived ability to imagine the change as desirable and feasible, thus empowering them to become active participants in the ecological transition.

Openness and Transparency Statements

The present article has been checked by its handling editor(s) for compliance with the journal's open science and transparency policies. The completed *Transparency Checklist* is publicly available at:
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Supplementary Materials. The following table provides an overview of the accessibility of supplementary materials (if any) for this paper.

Type of supplementary materials	Availability/Access
Data	
a. Study pre-test.	Bosone et al., 2023
b. Study data.	Bosone et al., 2023

Type of supplementary materials	Availability/Access
Other	
English version of study scenario texts, measures, correlations, and tables.	Bosone et al., 2023
Study/Analysis preregistration	
Preregistration for study.	Bosone & Thiriot, 2023

Badges for Good Research Practices.

Open data: YES.

Open code: NO.

Open materials: NO.

Preregistration: YES.

Diversity statement: NO.

Note: YES = the present article meets the criteria for awarding the badge. NO = the present article does not meet the criteria for awarding the badge *or* the criteria are not applicable.

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