



Large-Scale Disruptive Activism Strengthened Environmental Attitudes in the United Kingdom

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Abstract

The 2019 London Extinction Rebellion was the first attempt by environmental protesters to create prolonged large-scale disruption in a Western capital city. The effects on public opinion were difficult to predict because protests seen as extreme can reduce support, but protests seen as justified can increase support. We studied longitudinal opinion changes in a nationally representative sample ($n = 832$) before, during, and after the rebellion, in conjunction with experimental analysis of the causal effects of media reports ($n = 1441$). The rebellion was longitudinally associated with national increases in environmental concern, and activist media increased dissatisfaction with current government action. Reports from different media sources caused activism intentions and support to move in different directions, contributing to longitudinally increased polarisation in attitudes to activism. The rebellion had minimal effects on belief in whether ordinary people can produce relevant change (based on collective efficacy and support for a Citizens' Assembly). The rebellion thus apparently succeeded in strengthening general environmental attitudes without polarising them, and probably somewhat grew the pool of engaged activists, but did not lead to major growth in collective mobilisation or improved environmental policy.



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Keywords

environmental activism, civil disobedience, public opinion, Extinction Rebellion, longitudinal and experimental methods

Non-Technical Summary

Background

Most of the UK public and even the UK Government's independent expert advisors (Climate Change Committee) agree that the UK Government should do a lot more to tackle climate change. Responding to this lack of action, in April 2019 Extinction Rebellion began its first international rebellion. In London, tens of thousands of protesters blocked five central road junctions for ten days, resulting in heavy disruption to transport. This study examined the effects on public opinion.

Why was this study done?

It is important to understand whether the rebellion had any positive or negative effects on public opinion about environmental issues and about protest itself. Governments sometimes respond to public opinion by changing policy. Protests can grow or diminish depending on how the public responds.

What did the researchers do and find?

During the rebellion, public concern about the environment increased. This was probably in part caused by the rebellion. Using an experiment where some people were exposed to news stories about the rebellion, and some people were not, it was established that the rebellion did cause some effects, but it depended on the specific news source. For example, only activist social-media messaging increased public dissatisfaction with government action. Sample coverage from the BBC news and activist social-media messaging increased support for activism, but sample coverage from the Daily Mail decreased it. This can help explain why the public became slightly more polarized about activism itself, although overall support for activism did not decrease.

What do these findings mean?

Even very disruptive environmental activism can increase support for environmentalist causes, without causing polarisation. However, this might not apply in all contexts.

Highlights

- UK public opinion was studied longitudinally across the April 2019 Extinction Rebellion, which heavily disrupted London for ten days.
- Effects of media reporting about the rebellion were also studied experimentally.
- The rebellion probably caused an increase in public concern about the environment without causing polarisation.
- The rebellion caused increases or decreases in support for environmental activism depending on the news source.

The UK Government's independent expert advisors (Climate Change Committee, 2021, 2022) and the majority of the UK public (The Week, 2021) agree that the UK Government should do more to tackle climate change. Public concern in the UK is sufficiently widespread that climate demonstration participants have numbered in the hundreds of thousands (Taylor & Watts, 2019), and some individuals are so concerned they deliberately go to prison to draw attention to government inaction (Gayle & Taylor, 2021). For example, at the time of writing, for eight days of the last three weeks, protesters calling for the UK Government to improve home insulation have been blocking Britain's busiest road, the M25 London Orbital Motorway, resulting in hundreds of arrests (BBC, 2021a, 2021b).

Large-scale legal demonstrations and smaller-scale illegal and disruptive civil disobedience have both long been part of environmental movements in the UK and internationally (Doyle & MacGregor, 2014; Rootes, 2016). In the 1990s, movements such as Reclaim the Streets held disruptive street-party protests attended by thousands (Blanco, 2013). Not until very recently, however, have environmental movements focused on more sustained and large-scale civil disobedience in Europe and North America (Berglund & Schmidt, 2020; Bevan et al., 2020; Richardson, 2020). Presaged by movements in the Global South and by direct action against German coal mines (Temper, 2019), in 2018 both the Fridays for Future (school and youth strike) and Extinction Rebellion (XR) movements began. According to organisers, more than 1.4 million school children in 128 countries walked out of school in strikes in 2019 (Carrington, 2019). In April 2019 XR began its first international rebellion, that was in practice focussed on London with satellite events in other cities and countries. How many participants were involved is unknown, but more than 1,000 arrests were made, with five central London road junctions mainly blocked for ten days, resulting in heavy disruption to transport and giving credence to organisers' claims of tens of thousands of participants (BBC, 2019a, 2019b).

Until now, the effects of this unprecedented action on UK public opinion have not been clear. Available longitudinal opinion polls have not been tailored to examine the effects, although national opinion polls (Smith, 2019) and a study opportunistically using the Understanding Society UK Household Longitudinal Study (UKHLS) (Kountouris & Williams, 2023) suggest increases in pro-environmental attitudes. Most importantly, experimental evidence has been absent. The current work pairs a longitudinal nationally

representative survey with experimental exposure to media reports in a separate sample to examine the impact of XR's London April 2019 rebellion. The pairing of the two approaches allows opinion changes in the national population to be linked to causal properties of media reports.

Because of the relative novelty of persistent large-scale disruptive environmental protest in a Western capital city, it was unclear what type of effect it might have on public environmental attitudes. As reviewed below, it might have been positive or negative. Our study measured three broad types of opinion (two opinions for each type): *attitudes to environmental problems* (environmental concern and dissatisfaction with government action); *support for environmental activism* (support for XR's disruptive actions and personal activism intentions); and *belief in the capacity of ordinary people to produce relevant change* (collective efficacy and support for a Citizens' Assembly to address the climate emergency). Knowledge of XR was also measured, to examine the effects of the rebellion on knowledge of the organisation, and to examine whether this knowledge moderated change in opinions.

The choice of measured opinions was principally determined by XR's agenda; the study was designed and conducted as a collaboration between a participant in the rebellion (Ben Kenward) and an independent advisor (Cameron Brick) and thus evaluates the rebellion in terms of its intended effects on opinion. We therefore briefly discuss XR's goals and strategies for addressing the environmental crises. XR emphasises top-down change over individual responsibility for reducing environmental impact (Berglund & Schmidt, 2020; Farrell et al., 2019; Gunningham, 2019). Rapid governmental action is intended to be directly guided by a Citizens' Assembly chosen randomly from the general population through sortition, akin to UK or US jury service (Devaney et al., 2020; Extinction Rebellion, 2019). A government unwilling to act in this way is to be directly pressurised to do so through disruptive civil disobedience. This apparently anti-democratic strategy is justified by XR with reference to consistent failure of government to adequately address the crises (Berglund & Schmidt, 2020; Farrell et al., 2019; Gunningham, 2019), because of which XR declares "the bonds of the social contract to be null and void" (Extinction Rebellion, 2018). Also in 2019, the French Gilets Jaunes movement successfully caused the French Government to change some policies using similar tactics (Royall, 2020), although unlike XR they were not consistently non-violent.

This strategy was influenced by international observations that highly dedicated disruptive but peaceful protest movements can achieve regime change after activating a relatively small proportion of the population (Stephan & Chenoweth, 2011). Opinions differ about the importance of passive public support. Some argue that a movement can shift public opinion in the right direction and gain further recruits by using high-profile tactics to highlight issues, even if the tactics are broadly unpopular (Lam, 2021): essentially a radical flank argument (Haines, 2013; Simpson et al., 2022). Others emphasise indirect pressure on the government via influencing public opinion and involving other

actors (Gunningham, 2019), or argue that such a movement cannot create sufficient direct or indirect pressure to achieve change without appreciable public support for the movement itself (Matthews, 2020).

The studied opinions are key psychological predictors of pro-environmental behaviour, including activism. For example, environmental concern predicted behaviour in a nationally representative UK sample (Rhead et al., 2015) and activism in a large international sample representative of 16 countries (Marquart-Pyatt, 2012). Collective efficacy (the belief that individuals acting together can make a difference) appears a critical predictor of environment action (Chen, 2015; Cuadrado et al., 2022), including activism in a nationally representative US sample (Roser-Renouf et al., 2014). This relationship is complex and may not always apply (Hamann & Reese, 2020): in a small sample of XR activists, collective efficacy predicted activism intentions but not behaviour (Furlong & Vignoles, 2021). Despite the notorious gap between environmental intentions and actions (Kennedy et al., 2009), they are at least weakly associated (Levine & Strube, 2012). In sum, the outcome variables in this study are of interest not only to those who share XR's strategies for change, but to everyone interested in improvements to environmental policy or individual environmental behaviour.

Predicting how the rebellion would affect public opinion involves navigating a nuanced distinction between extreme and moderate protest. The distinction is not clear-cut and reflects a variety of factors including disruption, violence, participant numbers, composition, and ideology, but is important because protests perceived as extreme can be counterproductive (Feinberg et al., 2020; Gutting, 2020; Simpson et al., 2018). On the other hand, especially when not perceived as extreme, environmental protest generally increases support (Fisher & Nasrin, 2021). According to experimental (Bugden, 2020) and pseudo-experimental (Swim et al., 2019) studies, exposure to large peaceful marches can increase support for environmental movements and collective efficacy beliefs. Large protests may be effective because by communicating a large consensus of collective anger, they normalise pro-environmental attitudes and intentions (Sabherwal et al., 2021). Environmental protest in the United States is associated with emissions reductions (Muñoz et al., 2018) and national environmental legislation (Agnone, 2007). However, in line with the view that environmental protest is constructive when it is not unpopular, the association with environmental legislation is strongest when public environmental attitudes are more positive (Agnone, 2007). An important result of environmental protest is increased attention to the issues (Sisco et al., 2021). However, this leads to a dilemma for activists that more extreme protest attracts more attention but can polarise or reduce overall public support for the cause (Farrer & Klein, 2022; Feinberg et al., 2020).

This backlash might be partly caused by negative stereotypes of activists (Bashir et al., 2013), especially those perceived as extreme. Also, the public tends to see extreme protests as immoral or unreasonable (Feinberg et al., 2020; Simpson et al., 2018). This applies particularly when the relevant cause is seen as making progress through conven-

tional political mechanisms (Farrer & Klein, 2022), and the public differentiates more between violent and non-violent protest when government corruption is absent (Thomas & Louis, 2014). Extreme protest can therefore be seen as unjustified when it appears to ignore legitimate routes to change, but when legitimate routes are perceived as inadequate, extreme protest may not damage the broader movement. Experimental work has demonstrated that a radical flank effect can apply to the climate movement, whereby support for the movement mainstream can be increased by exposure to a faction using unpopular disruptive tactics, because the mainstream looks better in comparison (Simpson et al., 2022). The above reviewed literature focuses on radical environmental protest, but we note that similar positive and negative effects have been found regarding radical tactics deployed for other causes such as civil rights (Shuman et al., 2021).

We predicted that all outcome variables would be increased by exposure to the London April 2019 rebellion. Despite the rebellion being highly disruptive, we expected negative stereotypes and perceptions of unreasonable extremity not to counteract positive effects for four reasons. Firstly, a larger and more diverse group than is typically expected to engage in disruptive protest (Saunders et al., 2020) was expected to solicit a less demonising approach from national media (McLeod, 2007), more effectively convey a message of large-scale dissatisfaction (Sabherwal et al., 2021), and be less likely to evoke negative stereotypes of protesters (Bashir et al., 2013; Kurz et al., 2020). Secondly, XR strongly disavows violence (Farrell et al., 2019), and violence is a key reason why protest can backfire (Simpson et al., 2018). Thirdly, the cause may be seen as justified and failed by legitimate routes (Climate Change Committee, 2021, 2022; *The Week*, 2021), meaning that, unusually (Farrer & Klein, 2022), more extreme protest may be seen as legitimate (Bugden, 2020). Fourthly, disapproval of XR tactics might lead to increased support for more mainstream climate demands (Simpson et al., 2022).

To examine change associated with natural exposure to the rebellion, five opinion variables, and knowledge of XR, were measured in a nationally representative sample from a polling company before, during, and after. These outcome variables were expected to increase before-to-during (Hypothesis Set 1) and before-to-after (Hypothesis Set 2), but decrease during-to-after (Hypothesis Set 3) because some effects of environmental protest exposure are temporary (Sisco et al., 2021). Before-to-during and before-to-after changes in all opinion outcome variables were predicted to be moderated by change in knowledge about XR across the same time points (Hypothesis Set 4). These hypotheses were all preregistered (experimental: see Kenward & Brick, 2019a; longitudinal: Kenward & Brick, 2019b; see also Data History Statement in Kenward & Brick, 2024).

As well as examining change in central tendencies of opinions, we also monitored polarisation (variance) over time. As reviewed above, exposure to protest can shift observer opinions in different directions. Further, different individuals might experience the same protest in different ways, for example because of exposure via different media (Gardham, 2021) or different personal characteristics such as pre-existing sympathy with the cause

(Bugden, 2020). Because of these factors, we predicted polarisation in all five opinion outcome variables to increase before-to-during (Hypothesis Set 5) and before-to-after (Hypothesis Set 6), but decrease during-to-after (Hypothesis Set 7) because of temporary effects. The changes were predicted to be moderated by change in knowledge across the same time points (Hypothesis Set 8). These polarisation hypotheses were not preregistered.

A second sample, nationally representative only for age, sex, and ethnicity, was subject to an experiment very early in the rebellion, so that most participants could be exposed to national news reports before they had spontaneously viewed any themselves. This meant that the control group was still comparatively naïve. Three media sources were used: a BBC TV news video, a Daily Mail text article (so taken from the nationally most popular news source and most popular newspaper respectively, Ofcom, 2018), and an XR-produced social-media-style video. We predicted all six opinion outcome variables would increase in the BBC condition (Hypothesis Set 9) and the XR condition (Hypothesis Set 10), but we made no such prediction for the Daily Mail condition, because the Daily Mail is perceived as being the most right-wing mainstream UK newspaper (Smith, 2017). Because disparagement of protesters by such conservative news-sources is very common (Boyle et al., 2012), it was expected that when exposure to the rebellion was mediated by the Daily Mail, negative associations might sometimes be activated irrespective of the specific content of the selected article. However, we include different media primarily to explore the general possibility that different media has different effects, not because the specific media comparisons are important (and we note the confound that the Mail is the only written source).

We also investigated the moderation of media exposure effects by demographic variables and political and environmental opinions, based on previous work (e.g., Kenward & Brick, 2021). However, we report these analyses in Kenward & Brick (2024), because they are highly exploratory, use post-hoc methods, and involve many further relations between variables, increasing the false discovery rate.

Method

Data Source and Preregistration

Data collection was conducted by XR via commissioned companies (Prolific and Delta-poll). Ben Kenward participated in study design as a member of XR and Cameron Brick as an independent advisor. Anonymous data was publicly released by XR accompanied by a full description of collection methods (see XR Impact Assessment, 2023a). For further information, see our full Ethics Statement.

Methods of data pre-processing and analysis were preregistered, after data collection but before analysis (experimental: see Kenward & Brick, 2019a; longitudinal: see

Kenward & Brick, 2019b; see also Data History Statement in Kenward & Brick, 2024). All methods described here are as preregistered unless otherwise noted. All hypotheses were preregistered prior to hypothesis testing, except those regarding longitudinal changes in polarisation, and moderation analysis (Kenward & Brick, 2024), which must therefore be regarded as exploratory. No preregistered hypotheses are untested except for the moderating effects of learning about XR during-to-after, as very few individuals learned at this later stage.

Participants

Longitudinal Study

Participants were adults recruited by the polling company Deltapoll and paid an unknown sum, using quotas for gender, age, educational attainment, work status, region, and the 2017 General Election vote (Table 1). Deltapoll provided weights for each wave calculated by rim-weighting to a matrix of demographic variables: age; education; social grade; UK region; past vote; and political attention. Use of these weights therefore results in nationally representative estimates. Because of attrition, these weights depart more from uniformity in later waves. The planned sample size of 850 was determined by financial considerations and became 862 due to uncertainties in sampling methods.

Data was collected in three longitudinal waves, before, during, and after the period of the April 2019 rebellion in London, United Kingdom. The before period was the 11th to 16th of April, which inadvertently included two days after the rebellion had begun. For the 124 participants answering on these two days, data was therefore excluded if they reported having heard of XR (30 participants excluded). The data collection for the during period was between the 18th of April and 7th of May, but data collected after the 28th of April was excluded because the rebellion period was over (34 participants excluded). The after data-collection period was between 18th May and 6th June and all data was retained. After these exclusions the included sample sizes were 832 before, 540 during (attrition 35%), and 442 after (attrition 18%).

Experimental Study

Participants were adults recruited using the Prolific online-recruitment organisation's Representative Sample service and were thus matched to the UK national population for age, sex, and ethnicity (Table 2). Participants were each paid £0.87. The target sample size was 1500, chosen as the maximum size offered by this service. Participants were randomised to condition, resulting (after exclusions, see below) in 366, 353, 354, and 368 (total 1441) participants in control, BBC, XR, and Daily Mail conditions respectively.

Table 1*Demographics of Longitudinal Sample at the Before Wave*

Variable (scale)	Notes	% Missing in analysed sample	Description
Age (years)	—	0.0	$M = 49.3$; $SD = 17.8$
Gender (binary)	All participants reported a binary gender except for one, who was excluded from analysis	0.0	51.2% women
2017 General election vote (categorical)	Reduced to five categories (see table note)	0.0	41.5% conservative; 36.6% progressive; 15.1% unclear; 5.9% centrist; 0.8% green
Social grade (categorical)	Provided in four categories	0.0	34.4% AB; 27.9% C1; 12.9% C2; 24.8% DE
Annual income (categorical)	Reduced to three categories	8.0	32.0% £0 to £21,000; 44.8% £21,001 to £48,000; 23.2% >£48,000

Note. The source of all data is Deltapoll. Missing data is due to participants selecting “prefer not to answer” for income. Social grade is a system based on employment status and type commonly used by UK polling companies as a proxy for socioeconomic status, with A and B the highest and D and E the lowest (Ipsos Media CT, 2009). General election vote was reduced to five categories as follows: *conservative* (Conservative Party and UKIP), *progressive* (Labour Party and SNP), *centrist* (Liberal Democrat Party), *green* (Green Party), and *unclear* (Other, Did not vote, and Don’t know).

Table 2*Demographics and Covariates for Experimental Sample*

Variable (scale)	Notes	% Missing in analysed sample	Description
Age (years)	Prolific	0.1	$M = 44.2$, $SD = 15.4$
Gender (binary)	Prolific; all participants reported a binary gender	0.0	51.9% women
Education (binary)	Prolific; collapsed to university graduate or not	0.9	48.9% university graduates
Political spectrum position (7-point bipolar)	Study questionnaire; 7 = very right wing	6.7	$M = 3.7$, $SD = 1.4$
Environmentalist identity (7-point bipolar, from Brick & Lai, 2018)	Study questionnaire; mean of 4 agree-disagree items ($\alpha = .93$; 7 = max. agreement); example item “I see myself as an environmentalist”	0.9	$M = 4.3$, $SD = 1.4$

Note. Missing data is due to participants omitting an answer or selecting “don’t know”.

Of 1557 sessions, 46 were discarded because the participant reported in a post-display check that the video display failed; seven were discarded because they were additional sessions contributed by participants who already participated; and two were discarded because the participant began to watch video but answered no questions (these necessary exclusions were neglected at preregistration). Of the remaining participants, seven were excluded for claiming neither UK nationality nor residence; and 54 were excluded for reporting more than “a medium amount” of knowledge (4 on a 7-point scale) about XR, as participants were intended to be as naïve as possible about XR pre-manipulation. To facilitate this, participants were tested as early as possible after news was released, between the afternoons of the 15th and 16th of April (between 5 and 31 hours into the rebellion). The remaining sample after all exclusions was 1441.

Measures

Outcome variables for both studies, including example questionnaire items, internal reliability, and a summary of missing data, are listed in Table 3. Participants in both studies completed online questionnaires following recruitment by the respective data-collection companies. The full text of both questionnaires is available in the XR data release (see XR Impact Assessment, 2023a).

Participants were asked for opinions about issues they might not know about. Therefore, measurement of Citizens’ Assembly support was preceded in both studies by the following preamble:

A Citizens Assembly is composed of about 100 randomly chosen members of the public, who are advised by experts, and given time to think, discuss, and decide action. The Citizens Assembly is similar to a big jury.

Similarly, before participants indicated their support for disruption, for longitudinal participants only the Rebellion events in London were summarised. These preambles varied slightly between waves (to present the events as being planned, ongoing, or having been completed), were 101 or 102 words long, and contained one sentence describing the rebellion, one sentence arguing in favour of it, and one sentence arguing against it. Full texts are in the relevant document in the XR data release (XR Impact Assessment, 2023b, p.2). As an additional experiment, the preamble mentioned or did not mention that climate change would “[turn] millions into refugees”. This manipulation was intended to address different research questions to those focused on here, and the measures and analyses are therefore reported for completeness only in Kenward & Brick (2024).

Table 3

Public Opinion Outcome Variables

Outcome	Items	Internal reliability		% Missing in analysed sample		Example items and notes
		Exper.	Longit.	Exper.	Longit.	
<i>Attitudes to environmental problems</i>						
Environmental concern	3	$\alpha = .86$	$\alpha = .87$	0.3	3.1	"I worry about the effects of climate change in my lifetime in this country"; "Ecological breakdown ... is one of the greatest threats facing humanity".
Government action dissatisfaction	2	$r = .79$	$r = .82$	2.8	5.3	"The Government is doing a lot to tackle climate change" (both items were reversed).
<i>Support for environmental activism</i>						
Disruption support	2	$r = .84$	$r = .86$	1.0	4.8	"Do you support or oppose disruptive civil disobedience being carried out in London by the environmental campaigners?" Minor wording differences, for example "Extinction Rebellion" instead of "environmental campaigners" at during and after waves.
Activism behaviour intentions	5	$\alpha = .85$	$\alpha = .84$	0.1	3.9	"Talk about the issues with friends or family"; "Go on a protest march". Minor wording differences between studies in introduction of items.
<i>Belief in the capacity of ordinary people to produce relevant change</i>						
Collective efficacy beliefs	2 (1 used)	$r = .49$	Not measured	0.4	Not measured	"People are capable of working together to solve big social problems." The other item was discarded (see table note). Experimental study only.
Citizens' Assembly support	1	NA	NA	4.0	13.1	"Do you agree or disagree a Citizens Assembly would do a better job than UK Governments have done in tackling climate change and ecological breakdown?"

Outcome	Internal reliability		% Missing in analysed sample		Example items and notes
	Items	Exper.	Longit.	Exper.	
<i>Knowledge</i> Heard of XR	1	Not included	NA	Not included	"I have heard of Extinction Rebellion". Included as outcome variable in longitudinal study only.

Note. For brevity, longitudinal information is for the Before wave only. Internal reliability (Pearson's r or Cronbach's α) met preregistered criteria for combining items for all waves in all cases except for *Collective efficacy beliefs*. Preregistration of a response to unmet criteria for two-item variables was neglected; a decision to arbitrarily discard one item was taken before hypothesis testing. Missing data was due to participants omitting an answer or selecting "don't know". All items used 7-point Likert response scales except *Heard of XR*, which was *yes* or *no*. See data release at XR Impact Assessment (2023a) for full information.

Experimental Methods

Before responding, experimental study participants viewed media content about the first day of the rebellion (Figures 1a, 1b, 1c), or in the case of control participants, a one-minute BBC news video about finding the location of Shakespeare's house in London (playable at XR Impact Assessment, (2019a)). In the BBC condition, participants viewed a 3-minute BBC news clip describing activists blocking Waterloo bridge (playable at XR Impact Assessment, (2019b)); in the Daily Mail condition participants read an 353-word online Daily Mail article similarly describing the rebellion (viewable at XR Impact Assessment, (2019c)); in the XR condition, participants viewed a 3.5-minute video of the type typically shared by activists on social media, featuring an activist explaining their reasons for participating (playable at XR Impact Assessment, (2019d)). The BBC and Daily Mail coverage were both relatively neutral towards the rebellion. The XR video was supportive of the rebellion and the message was aimed (through the activists' personal appearance and language choices) at the political centre. Experimental conditions are named according to media sources for clarity, not because the content is necessarily representative of each source. Before viewing the media, participants were informed that afterwards they would be asked questions about the media content. The purpose of these questions was to encourage attention to the media and responses were not analysed.

Figure 1a

Experimental Stimulus (a)



Note. This still image is from a BBC video.

Figure 1b

Experimental Stimulus (b)



Note. This still image is from an XR video.

Figure 1c

Experimental Stimulus (c)

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Commuters face chaos on their journeys home as thousands of eco-warriors block roads and Tube entrances in central London with police arresting three as protesters 'glue' themselves to the Shell building and smash doors

- Environmental protesters analyse London's roads by creating human barricades at five landmarks
- Extinction Rebellion organisers claim 30,000 eco-protesters are expected to block major routes today
- Human barricades at Marble Arch, Oxford Circus, Waterloo Bridge, Parliament Square & Piccadilly Circus
- Global movement demands UK Government takes urgent action on climate change and wildlife declines

By MARK DUELL FOR MAILONLINE and ARIELER MARTIN FOR THE DAILY MAIL
PUBLISHED: 09:15 AM GMT+0 | UPDATED: 10:02 AM GMT+0

Commuters leaving London tonight face a chaotic journey home with thousands of climate change protesters blocking key transport hubs during a co-ordinated day of action at five landmarks.

Some activists glued themselves to the windows and smashed glass revolving doors at Shell's headquarters near Waterloo, while others spray-painted graffiti and hung banners on the building.

Workers returning home from areas around Waterloo Bridge, Oxford Circus, Marble Arch and Piccadilly Circus face being unable to get through by road to Underground stations thanks to the Extinction Rebellion protests.

Police said three men were arrested on suspicion of criminal damage over the Shell incident. Extinction Rebellion claimed they aimed to cause more than £6,000 in damage so they can be tried by a jury in the crown court.

Activists are targeting five locations - the fifth being Parliament Square - as they demand the Government declare a climate emergency, but organisers warned they could be arrested for blocking traffic.

Protesters are holding people's assemblies, performances, talks and workshops - with a colourful display of flags bringing normally busy routes to a standstill, and trees placed on Waterloo Bridge making it a 'Garden Bridge'.

Slateboarders replaced cars and lorries on Waterloo Bridge, with police saying there were no plans to move protesters on - but indicated that the response could change if there is major disruption at rush-hour.

One officer said: 'It's been very peaceful so far. Everyone has been really pleasant. The only grief we've had is from passing motorists shouting at them 'cos a job - that's about as exciting as it's got'.

Climate protest group Extinction Rebellion block London's Oxford Circus today at the start of a week of planned protests

Note. This still image is from an article from the Daily Mail.

Analytic Plan

All described methods, including analysis, were preregistered unless otherwise noted. Analyses were carried out using R 4.2.2 (R Core Team, 2022) and the packages *boot* (Canty & Ripley, 2021), *weights* (Pasek et al., 2021), *ggplot2* (Wickham, 2016), *MKinfer* (Kohl, 2022), *lme4* (Bates et al., 2015), *plyr* (Wickham, 2011), *Hmisc* (Harrell, Jr., 2023), and *psych* (Revelle, 2022). Analysis code is available at Kenward (2023).

Scale Composites

Outcome variables and the environmentalist identity covariate in the experimental study were calculated as a mean of all non-missing item scores, provided at least half of the items were not missing (otherwise the score was missing) and provided Pearson's $r > .5$ (for variables with two items) or Cronbach's $\alpha > .5$ (for variables with three or more items). These reliability criteria were unmet only once, resulting in a collective efficacy belief item being discarded (see Table 3).

Longitudinal Analysis

To test hypotheses about changes in central tendencies in opinion outcome variables listed in Table 3 (Hypothesis Sets 1 to 3), bootstrapped paired-sample t -tests compared the mean values for each of the three waves. The t -tests were unweighted, whereas the Cohen's d effect size estimates were weighted. This approach was intended to avoid reduction of test power by weighting, but to nevertheless provide effect sizes which are the best possible estimates of national population values.

To test hypotheses that polarisation (variation) would change longitudinally (Hypothesis Sets 5 to 7), an identical approach was used, except that each data point was transformed to its absolute difference from the mean (e.g., we used the absolute difference between a concern score and the mean concern score for that wave). Thus, each individual has a polarisation score where a higher number indicates their opinion score is a greater distance from the mean. Hypotheses and analyses about polarisation were not preregistered, but an identical approach to the central tendency analysis (without exploration of alternative approaches) was used to restrict researcher degrees of freedom.

McNemar's tests were used to compare proportions of people who had heard of XR at different waves (Hypothesis Sets 1 to 3). For the same reasons as before these comparison tests are unweighted but the proportion descriptions are weighted (although this was not preregistered).

To test hypotheses that longitudinal change would be moderated by knowledge of XR acquired between waves (Hypothesis Sets 4 and 8), during-wave participants were allocated to two groups; those who had now heard of XR (learners; $n = 250$), and those who still had not (non-learners; $n = 223$). During-wave participants who had already heard of XR at the before wave were excluded from this analysis ($n = 48$). Unweighted bootstrap t -tests were conducted to compare the two groups' participants' change in

each variable. The same analyses had been preregistered for the during-to-after change but were not carried out because only 60 participants learned of XR between those waves.

Experimental Analysis (Hypothesis Sets 9 and 10)

For each of the six experimental outcome variables (Table 3), an ANCOVA was conducted assessing the effect of condition, controlling for all covariates listed in Table 2. Diagnostic scatter-plots of residuals revealed questionable model fits for several outcome variables. A solution to poor model fit was not preregistered. We chose to optimise both robustness of analysis and conformity with standard practice: ANCOVA F -ratios for the effects of condition were used to calculate p -values using both the standard parametric method and a non-parametric randomisation method (Eudey et al., 2010); differences between these p -values were very small (at most .002) and did not impact significance, so standard parametric analyses are reported.

The preregistration specified that pairwise comparisons would be made, for each manipulation group versus the control only, but did not specify a method for these comparisons. Bootstrapped 95% confidence intervals (95% CIs) were constructed for the regression coefficients comparing each manipulation condition with the control condition in the ANCOVA models, with an effect assumed to exist when the 95% CI excluded a value of zero. These coefficients and associated confidence intervals are presented standardised by conversion to Cohen's d .

Common to All Analyses

All randomisation methods (bootstraps and permutation tests) used 99,999 samples. All CIs were calculated using the adjusted percentile bootstrap (Carpenter & Bithell, 2000). Participants were missing from any analysis for which relevant data was missing; no imputation methods were used (covariates would have been dropped if > 15% of data was missing, but this did not occur).

Results

The proportion of people who had heard of XR increased from 9% before the rebellion, to 48% during, and 50% after (proportions weighted to reflect national population). The before-to-during and before-to-after increases were both significant at $p < .001$, but there was no significant during-to-after change, $p = .720$ (unweighted McNemar's tests). Table 4 summarises longitudinal changes in central tendency and polarisation (Hypothesis Sets 1 to 3 and 5 to 7, Table 5), moderation of such changes by learning about XR (Hypothesis Sets 4 and 8, Table 6) and effects of media exposure (Hypothesis Sets 9 and 10, Table 7). Table 4 includes graphical descriptions of experimental effects and longitudinal changes;

for numerical descriptions, see Additional Descriptive Statistics section in Kenward & Brick (2024).

Table 4

Results Summary

Significant effects in bold (Tables 5, 6, 7)	Longitudinal distributions	Experimental effects
Attitudes to environmental problems		
<p><i>Environmental concern</i> Small longitudinal increases before-to-during and before-to-after, no longitudinal changes in polarization, no longitudinal effects of learning about XR, and no effects of experimental exposure to media.</p>		None
<p><i>Government action dissatisfaction</i> No longitudinal changes (including no effects of learning about XR). Exposure to XR-produced video causes small increase, but no effect of BBC clip or Daily Mail article.</p>		

Significant effects in bold (Tables 5, 6, 7)

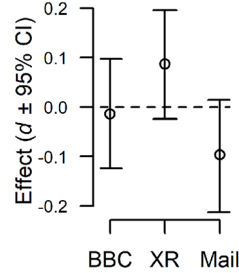
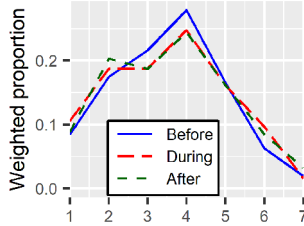
Longitudinal distributions

Experimental effects

Support for environmental activism

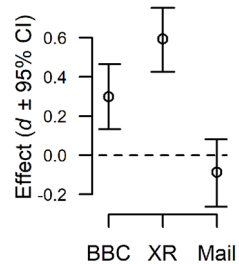
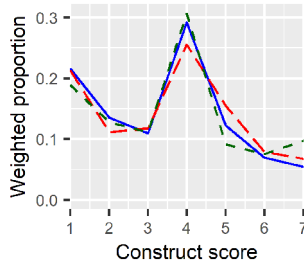
Activist behaviour intentions

No longitudinal changes in central tendency but **small increases in polarisation before-to-during and before-to-after**. No effect of learning about XR. **Overall effect of media exposure, created by very small tendency of XR video to increase and very small tendency of Mail to decrease**, with no effect of BBC.



Disruption support

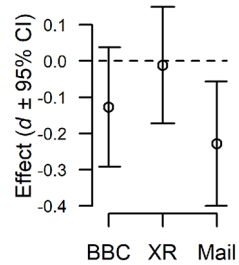
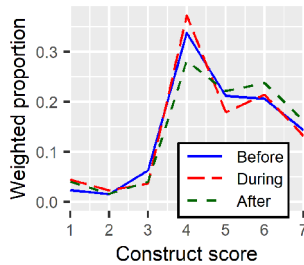
No whole-sample longitudinal changes in central tendency but **greater increases from before-to-during for those who learned about XR**. **Small increases in polarization before-to-during and before-to-after**, with more **before-to-during polarisation for those who learned**. **Exposure to XR video causes medium-to-large increase, BBC clip causes small increase**, but no effect of Daily Mail.



Belief in the capacity of ordinary people to produce relevant change

Citizens' Assembly support

No longitudinal effects (including no effects of learning about XR) except **a small increase in polarisation before-to-during**. **Daily Mail article causes small decrease** with no effect of BBC or XR media.



Collective efficacy beliefs

Not included

None

Note. Longitudinal distributions are weighted. Experimental effects are effect sizes of media conditions relative to control.

Table 5

Longitudinal Change Across Waves

Outcome	Before-to-during change				Before-to-after change				During-to-after change			
	Central tendency		Polarisation		Central tendency		Polarisation		Central tendency		Polarisation	
	<i>p</i>	<i>d</i>	<i>p</i>	<i>d</i>	<i>p</i>	<i>d</i>	<i>p</i>	<i>d</i>	<i>p</i>	<i>d</i>	<i>p</i>	<i>d</i>
Environmental concern	.015*	0.06*	.743	-0.03	.010*	0.16	.493	0.08	.844	0.08	.854	0.08
Government action dissatisfaction	.962	-0.10	.956	-0.11	.577	0.01	.078	-0.05	.948	0.10	.232	0.05
Activism behaviour intentions	.393	-0.04	.001*	0.15	.395	-0.05	.000*	0.18*	.712	-0.01	.191	0.03
Disruption support	.152	0.06	.000*	0.20	.061	0.15	.000*	0.36*	.816	0.00	.124	0.06
Citizens' Assembly support	.201	-0.02	.048*	0.16	.690	0.16	.072	0.25	.534	0.08	.490	0.01

**p* < .05.

Table 6

Moderation of Before-to-During Longitudinal Change by Learning About XR

Outcome	Central tendency change			Polarisation change		
	Learner vs. non-Learner <i>p</i>	Learner <i>d</i>	Non-learner <i>d</i>	Learner vs. non-Learner <i>p</i>	Learner <i>d</i>	Non-learner <i>d</i>
Environmental concern	.308	—	—	.320	—	—
Government action dissatisfaction	.250	—	—	.247	—	—
Activism behaviour intentions	.797	—	—	.791	—	—
Disruption support	.000*	0.20	-0.02	.001*	0.34	0.12
Citizens' Assembly support	.419	—	—	.437	—	—

Note. Separate *d*-values for learners and non-learners are omitted where the groups do not differ statistically; refer instead to Table 5.

**p* < .05.

Table 7*Omnibus Tests of Experimental Media Exposure*

Outcome	<i>df</i>	<i>F</i>	<i>p</i>
Environmental concern	3, 1315	0.94	.419
Government action dissatisfaction	3, 1288*	4.46*	.004*
Activism behaviour intentions	3, 1318*	3.53*	.014*
Disruption support	3, 1313*	27.20*	.000*
Citizens' Assembly support	3, 1275*	3.22*	.022*
Collective efficacy beliefs	3, 1312	2.30	.076

Note. Each variable is modelled separately: see Analytic plan.

* $p < .05$.

Discussion

The rebellion had a strong impact on public awareness: before, less than one in ten had heard of XR, whereas afterwards half of our nationally representative sample had. Awareness of the large-scale disruption of London was probably even greater, as participants were only asked about the name of the responsible organisation. This increase in awareness of the rebellion was accompanied by before-to-during or before-to-after increases in polarisation of attitudes towards activism. Environmental concern increased slightly without increased polarisation. Longitudinal increases in polarisation can be at least partly explained by some media causing increases in opinion and other media causing decreases or having no effect, as detailed below. Only one opinion variable (support for disruption) increased more for those who gained knowledge of the rebellion. There were no during-to-after decreases in any outcome variable, meaning there is no evidence that longitudinal changes were temporary (Sisco et al., 2021). All Hypothesis Sets except 3 and 7 were therefore confirmed for some outcome variables and disconfirmed for others; 3 and 7 (during-to-after decreases) were entirely disconfirmed.

Exploratory analyses of media effect moderation by participant individual characteristics are reported in Kenward & Brick (2024). Participant environmentalist identity moderated media exposure effects for three of six opinion outcome variables, age moderated effects on concern, very weakly, but political spectrum position (left–right) and further demographic variables appeared not to moderate any effects. Such moderation by environmentalist identity provides another likely explanation for longitudinal increases in polarisation, particularly regarding support for disruptive activism. We now consider further details regarding each pair of opinion variables.

Attitudes to Environmental Problems: Concern and Dissatisfaction With Government Action

Environmental concern in the nationally representative sample saw a small increase over the rebellion, with no increase in polarisation. The cause of this increase could not be definitively attributed to the rebellion because experimental media exposure did not on average increase concern, and longitudinal increases were not associated with learning about XR. Other explanations for the increase include the school strike movement that was also prominent during 2019 (Carrington, 2019; Cologna et al., 2021), and a documentary by David Attenborough that received widespread national attention (Nicholson, 2019). However, the exploratory moderation analysis did suggest a causal role for the rebellion: the XR video may have increased concern for those with a stronger environmentalist identity and decreased concern for those without.

Convergent evidence from other longitudinal polling using an apparently more sensitive measure indicates that the measure used here may have led to an underestimate of shift in public concern. When nationally representative samples were asked to select the three most important issues facing the country, the percentage selecting the environment changed from roughly 17% immediately before the rebellion to roughly 27% afterwards (Smith, 2019). Although this evidence is also only correlational, the large shift precisely timed with the well-publicised rebellion (and not, for example, a prominent school strike) suggests that the rebellion was primarily responsible.

In contrast to environmental concern, public dissatisfaction with government action was not detected to increase longitudinally, but experimental exposure to XR-produced media did cause a small-to-medium increase. The fact that only a few minutes' exposure to direct activist messaging increased dissatisfaction with government action underlines the effectiveness of activists reaching audiences directly, unfiltered by mainstream media, as this effect was not observed for the BBC or the Daily Mail. The lack of detected longitudinal effect can be reconciled with the experimental results if one assumes that almost everyone in the national population heard about the rebellion from the established media. However, another study which opportunistically used the UKHLS did find a longitudinal change during this period in a similar measure: a reduction in opposition to national measures against climate change (Kountouris & Williams, 2023).

There was no evidence for a population-level reduction or polarisation in attitudes to environmental problems in response to the rebellion (Kountouris & Williams, 2023; Smith, 2019). This is also consistent with further recent experimental evidence that disruptive protest does not necessarily reduce support for mainstream environmental issues, even amongst demographics typically hostile to such protest (Bugden, 2020; Simpson et al., 2022). When the environmental cause is seen as neglected by authority, disruptive action can be forgiven to the extent that opinion regarding the cause is not negatively impacted, even when the action is not supported (Farrer & Klein, 2022). Disapproval of what is seen as a radical minority within the movement can even increase support

for mainstream demands (Simpson et al., 2022), which may partly explain the observed increase in environmental concern.

Support for Environmental Activism: Disruption and Intentions to Participate in Activist Behaviour

In the experimental study, BBC and XR videos caused small and medium-to-large increases in support for disruption respectively, with no effect of the Daily Mail. Exploratory moderation analyses suggested these effects were stronger for those with stronger environmentalist identity. Very small experimental effects were observed for activism intentions, with the Mail slightly decreasing and XR slightly increasing. These different effects are consistent with and can help to explain why polarisation increased longitudinally for both variables, without detected changes in central tendency. This integration of experimental and longitudinal results supports the idea that different media sources reporting differently on activism contributes to national attitude polarisation (Lee, 2014; McLeod, 2007; Swim et al., 2019). Indeed, analysis of UK media reporting on the April 2019 rebellion suggested mixed coverage, with some but not all sources presenting more positive coverage than expected based on previous reporting (Gardham, 2021; Hayes & O'Neill, 2021).

Although there was no longitudinal increase in disruption support, two observations suggest that the increased polarisation was more due to increases amongst those already more supportive, than to decreases amongst those already less supportive. Firstly, no media was experimentally observed to cause a decrease, but BBC and XR videos caused increases. Secondly, learning about XR was associated with differences in longitudinal change in disruption support, with those who learned showing a small increase before-during, but those who did not learn showing no change.

Activism intentions became more polarised without an overall reduction. This implies intentions that were already comparatively strong were further strengthened (and those already weak were weakened). Further, those who learned more about the rebellion came to support it more. These observations are consistent with a temporal analysis of XR local-group formation suggesting that the April 2019 Rebellion led to an increase in formation of such groups (Gardner et al., 2022). In line with previous conclusions based on experimental data (Bugden, 2020), these results suggest that XR and similar organisations can increase support for and engagement in disruptive action by performing disruptive action, especially amongst those more predisposed towards support.

Although exposure to XR media caused a medium-to-large increase in support ($d = 0.6$), increases in intentions to join in with activism were modest in comparison ($d = 0.1$). It seems much easier for disruptive activists to cause dissatisfaction with the government and support for activism than to cause people to intend to join in.

Belief in the Capacity of Ordinary People to Produce Relevant Change: Collective Efficacy and Support for a Citizens' Assembly

There was no experimental effect of any media on collective efficacy beliefs. Constructive pessimism and demotivating fatalism are similar but distinct, and can have respectively positive or negative effects on efficacy beliefs (Morris et al., 2020). XR's emphasis on catastrophe may motivate increases in efficacy belief for some and decreases for others. Alternatively, a brief exposure to XR may not change minds about the efficacy of collective action (this variable was not investigated longitudinally).

Support for a Citizens' Assembly showed a small increase in polarisation before-to-during, with no change in central tendency. Support levels overall were high, in line with some other work that has examined public opinion about Citizens' Assemblies and found it mixed but generally supportive (Giraudet et al., 2022; Sandover et al., 2021). However, the relevant Likert item confounded support for a Citizens' Assembly with lack of support for successive UK governments, by asking about relative preference.

The experimental results showed that the Daily Mail reduced Citizens' Assembly support, whereas the other two media conditions had no overall effect. However, exploratory moderation analyses indicated XR media may have increased support for those with a strong environmentalist identity and decreased it for those without. The overall effect for the Daily Mail is puzzling as no mention of a Citizens' Assembly was made in the article. It is possible that because the Daily Mail is well known for its right-wing slant, a simple exposure effect occurs whereby its characteristic style and vocabulary reduces trust in ordinary people relative to trust in government. The small longitudinal increase in polarisation in Citizens' Assembly support could be the result of such effects, together with positive effects of types not detected in the experiment. Many Citizens' Assemblies on climate have now occurred, including in the United Kingdom, tending to result in more radical proposals for climate policy than produced by government, but regarded as advisory rather than decision-making bodies (Duvic-Paoli, 2022; King & Wilson, 2023; Wells et al., 2021).

Limitations

Longitudinal Attrition and Representativeness of Sample

Although we have assumed the nationally representative sample can be generalised to the national population, polling company samples are stratified and weighted rather than being probabilistic. In most cases this probably results in error of just a few percentage points, but this is not guaranteed (Keeter, 2015). Further, it is questionable whether the longitudinal sample was still nationally representative after experiencing attrition, despite updated weighting. Longitudinal effects cannot be biased artefacts of attrition, but they might only apply to subsamples of the population, with different effects applying in the subsample that was no longer measured. We know of no specific reason

why that would be the case here, and two key longitudinal results are independently corroborated (increase in environmental concern by other longitudinal data; increase in disruption support for those learning about XR by the experimental study). Further, all the longitudinal effects were detected before-to-during, for which attrition was 35%, so it can be said that the observed longitudinal effects apply at least to roughly two-thirds of the population. However, given the high attrition level, a repeated cross-sectional design might be appropriate for future studies. The longitudinal design allowed for paired-sample analysis, but this might not be sufficient to offset the disadvantage of attrition. The experimental sample, while balanced to national profile for age, gender, and ethnicity, was slightly left of political centre, and more educated than the national population, indicating it was not perfectly representative, but nevertheless broad.

Generalisability

Effects of exposure to the rebellion appeared to be moderated, particularly by the environmentalist identity of the exposed observer, and depended on the specific media. Further, we selected from the media sources the coverage most easily available in the first hours of the rebellion, not the coverage most representative of those sources, and effects might additionally vary across different coverage from those same sources. These observations all underline the fact that it can be difficult to generalise and predict the overall effects of a complex phenomenon such as disruptive activism.

The current results are from the period before the economic crises caused by COVID-19 and Putin. The broader context will determine how the public responds to protest movements, and specific actions taken by a protest movement may change the way its activities are interpreted. Later in 2019, during another rebellion in London, XR probably damaged its popularity with the Canning Town action, which inadvertently disproportionately affected poor and ethnic minority Londoners (Ibbetson, 2019), and growth of the movement following this event tailed off (Gardner et al., 2022). However, the UK public wanted the environment to be prioritised as part of post-COVID-19 economic recovery (Kenward & Brick, 2021). The UK public also regarded the environmental crisis as more serious than COVID-19, and was not subject to a finite pool of worry effect with regard to the two crises (Evensen et al., 2021). Further, recent preliminary evidence suggests that very disruptive (though smaller scale) environmental protests in 2022 did not produce backlash effects in UK public opinion and may even have had some positive effects (Ozden & Glover, 2022; Ozden & Ostarek, 2022).

Nonetheless, care should be taken in assuming the currently observed effects would apply to other populations and contexts. For example, as the Canning Town incident indicates, there can be a sensitivity to disruptive actions that affect disadvantaged groups. This might be particularly relevant in countries that are comparatively disadvantaged compared to the UK. Fatigue effects in future contexts are also possible as large-scale

disruption becomes less novel. XR itself has recently pledged to disrupt only government, not the general public (Extinction Rebellion, 2023).

Replication is particularly important for our non-preregistered analyses. For the polarisation analyses, we formed hypotheses prior to any exploration, and to reduce our degrees of freedom, used the same analysis methods as preregistered for exploration of central tendency. The same is not true of the moderation analyses. All these results must be regarded as exploratory and in need of confirmation, particularly the moderation analyses.

Conclusions

This was the first experimental investigation of the effects on public opinion of the first prolonged large-scale disruption of a Western capital city by environmental protestors. It revealed positive effects on general environmental attitudes, no reduction in overall support for environmental activism, and polarisation only in attitudes specific to activism and a Citizens' Assembly. The actions had effects on observers that likely caused XR to grow (Gardner et al., 2022). The effects persisted through all longitudinal waves. This establishes that in principle, large-scale disruptive activism can have effects on public opinion that can in turn (as reviewed in the introduction) result in actions and policy that improve the environment. This might be taken as encouraging for those dedicated to such methods. However, such outcomes are not guaranteed. The results also indicate that it is much easier for disruptive activists to generate passive than active support, and that their messages are appreciably less effective when mediated by mainstream media than when they reach people directly. Although XR is larger than previous similar movements, it still represents a tiny fraction of the national population, and the growth which followed the April 2019 rebellion later tailed off (Gardner et al., 2022). Further, increases in concern amongst the public have not obviously translated into changes in public policy. According to its own expert advisors, UK government environmental policy is still summarised by “major failures in delivery” and is still inadequate to deliver its own targets (Climate Change Committee, 2021, 2022).

The work also underlines causal complexities, with different media items creating different effects on different opinions in different people. These complexities underlie activist dilemmas. If responses to activism depend on observer environmentalist identity, should activists continue to target the more receptive audiences, or change messaging to better reach those currently less receptive? If activism increases passive support much more than joining intentions, and leads only to limited further mobilisation, what is that activism achieving? If environmental activism appears to influence those on the political centre-right similarly to those on the left, could activists gain from softening their left-wing associations, or would this alienate their base supporters? In general, what types of activism appeal in which ways to which people and in which contexts, and how does this lead to downstream effects on policy and emissions and biodiversity?

Answers to these questions can only come from work focusing on the multiple processes by which activism might produce concrete results, and which can quantify the balance of these trade-offs.

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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Author Contributions.

BEN KENWARD: Conceptualization. Data curation. Methodology. Formal analysis. Funding acquisition. Project administration. Writing – original draft. Writing – review & editing.

CAMERON BRICK: Conceptualization. Data curation. Methodology. Formal analysis. Writing – review & editing.

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Competing Interests. Ben Kenward took an active role in the Extinction Rebellion actions that this study is designed to evaluate; Cameron Brick took no such role and has no interests in the actions, but is an Associate Editor of *Global Environmental Psychology*.

Ethics Statement. Ethical approval of analysis of this public repository data was granted by the University of Amsterdam (2022-SP-14322). Deltapoll adheres to the UK Market Research Society's Code of Conduct (Market Research Society, 2014) and data-collection via Prolific adhered to the British Psychological Society's Code of Human Research Ethics (British Psychological Society, 2014). Participants gave informed consent.

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	
Anonymous data.	XR Impact Assessment, (2023a)
Code	
Analysis code.	Kenward, 2023

Type of supplementary materials	Availability/Access
Material	
a. Control participants experimental study video.	XR Impact Assessment, (2019a)
b. BBC condition experimental study video.	XR Impact Assessment, (2019b)
c. Daily Mail condition experimental study video.	XR Impact Assessment, (2019c)
d. XR condition experimental study video.	XR Impact Assessment, (2019d)
e. Study questionnaires.	XR Impact Assessment, (2023b)
Study/Analysis preregistration	
a. Preregistration of experimental hypotheses.	Kenward and Brick, 2019a
b. Preregistration of longitudinal hypotheses.	Kenward and Brick, 2019b
Other	
a. Supplementary acknowledgements, figures/tables, detailed procedure explanations, data history statement.	Kenward and Brick, 2024
b. Collection methods description.	XR Impact Assessment, (2023a)

Badges for Good Research Practices.

Open data: YES.

Open code: YES.

Open materials: YES.

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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