Measuring Pro-environmental Behaviour and its Determinants

A quick scoping review of existing closed answer measures and design considerations to inform survey design

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Foreword

Natural England commissioned this report to build its understanding of how pro-environmental behaviours and their determinants can be best measured through surveys like the ‘People and Nature Surveys’.

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Executive summary

Background and aims: Positive change to address global environmental issues requires a range of actors and dimensions, including individual, community, political and cultural change. This is demonstrated through the varied indicators of positive change included within England's Environmental Improvement Plan and Outcome Indicator Framework (Defra, 2022; 2023). The current quick scoping review focuses on individual 'pro-environmental behaviour' (PEB) and the many factors (i.e., determinants) that may influence whether or not individuals engage in PEB, in line with the 25 Year Environment Plan (25YEP) indicator 'G6: Environmental attitudes and behaviours' (Defra, 2022). Understanding individual PEB and its determinants is one important part of wider efforts towards the protection and restoration of our natural environments.

The aim of this quick scoping review was to build on the work of Valkengoed et al. (2022; in Nature Human Behaviour)—the most recent and comprehensive overview of key behavioural determinants of PEB—by providing practical insights into how PEB and its key determinants can be measured most effectively through closed-answer surveys (those with predefined answer options). The insights collected in this work aim to provide synthesised, practical advice on how surveys and evaluations might better measure these constructs, to grow our understanding of what influences PEBs, and to better inform programmes and policy in this space.

Methods: In total, 177 papers published between 2013 and 2023 met the criteria for inclusion in this quick scoping review. These papers captured 624 measurements of 17 behavioural determinants, and in 98 of these papers the authors also explicitly measured PEB (not just behavioural intent). By also reviewing common question formats used, common biases that may occur in the use of closed question formats, and common data analysis approaches, the review highlights further important considerations for use of closed-answer surveys. Such insights are relevant both when measuring PEB and its determinants, as well as more generally when using closed-answer questions to measure psychological constructs.

Insights and considerations for survey design

The review identified robust approaches to measuring PEB and its determinants, and specific validated measures from previous research are outlined in Table 3. In addition, the following key areas were recommended for consideration when measuring PEB and its determinants:

Use measures validated for a given participant group: To ensure questions are appropriate for the measurement of PEB/determinants for a given target audience, surveyors should use measures validated with that group. Where none are available, existing questions could be tested and validated with the target group, or new questions developed. The development of new questions should consider existing literature, consult experts in the field, and pilot and validate measures appropriately before use. Piloting how

questions are interpreted is particularly important when studying a new group with possible differences in understanding (e.g., children or those with cognitive disabilities).

Balance reducing cognitive burden/non-response bias and meeting data needs: Considering cognitive burden when choosing survey questions is important, both for participant welfare and to reduce non-response bias. Non-response bias is when the views of those who are less willing to participate are therefore underrepresented. Trying to minimise cognitive burden is especially important for children, those typically less engaged with research, or groups with cognitive disability. You might do this by:

- *Considering first how the data will be used/analysed and the outputs that are needed from this data,* drawing from this the minimum insights you aim to achieve from questioning and informing the detail of questioning needed;
- *Minimising both the number and complexity of response options* e.g., by using multiple choice rather than multiple scale questions, or shorter scales;
- *Considering the impact of survey format* on ease of responding e.g., online surveys might use drag and drop options for ranking questions, or scale sliders for scale questions.

Reduce social desirability and recall biases: Social desirability bias occurs when respondents (consciously or subconsciously) modify their responses to match what they think the surveyor wants to hear. Recall bias can occur when people are asked to recall/report on previous behaviours but are unable to do this accurately. To help mitigate against these biases, survey designers can:

- Ensure *anonymity and confidentiality of responses;*
- *Ask about concrete behaviours/action* where possible;
- *Use multiple and reverse coded items* - including multiple items that are framed from opposing directions can reduce social desirability bias and corroborate the responder's 'true' response;
- *Validate or use validated measures that have tested a given phrasing/timeframe for recall* for the specific behaviour and/or audience in question e.g., the past week versus the past month, or using a temporal landmark (e.g., 'since Christmas have you…').

Mitigate against order effects: the way that questions and within answer options are ordered can affect responses in a systematic way that biases conclusions drawn. Order effects that should be considered include:

- Consider how *proceeding questions may 'prime' respondents* into thinking about a certain topic when answering later questions (related to social desirability bias) and mitigate against this where possible through re-ordering;
- Within multiple choice answer options, consider *primacy and recency effects* which cause respondents to focus on the first and last answer option in a list. Broadly it is good practice within answer options, to *randomise positively and negatively phrased items/options*;

- When looking for a ‘right’ answer, respondents tend to look to the *middle answer option* (e.g., option ‘C’), particularly if they are unsure. Again, randomisation may reduce this order effect.

Balancing participant choice and completeness of data: survey respondents should always be free to withdraw from a survey, but the availability of responses that allow a more neutral response may affect the balance achieved between completeness of data (including mitigation against social desirability bias) and retention of participants. Two examples are:

- Including a *‘don’t know’* or *‘prefer not to say’* type answer option- Having one can allow respondents to opt out of answering if they are unsure or uncomfortable and so may increase retention of participants, but not having one can encourage respondents to make a choice, thereby reducing passive and opt-out responses.
- *Scale mid-points* – not allowing mid-range responding (e.g., 6-point scale) can reduce social desirability bias by encouraging a response either in favour/against a statement, but including a mid-point (e.g., 7-point scale) may improve response rates and provides an option for those who do not agree or disagree.

In conclusion: this report provides a novel exploration of how PEB and its key determinants might be measured as a resource for surveys to better inform growing programmes and policy around PEB. By better understanding and measuring PEB and its determinants more broadly, as well as in relation to specific contexts and interventions, PEB can be better used to benefit both people and nature.

Contents

Background

Positive change to address global environmental issues requires a range of actors and dimensions, including individual, community, political and cultural change. This is demonstrated through the varied initiatives included within England's Environmental Improvement Plan and Outcome Indicator Framework (Defra, 2022; 2023). The current literature review focuses on individual 'pro-environmental behaviour' (PEB) and the many factors (i.e., determinants) that may influence whether or not someone engages in PEB, in line with the 25 Year Environment Plan (25YEP) indicator 'G6: Environmental attitudes and behaviours' (Defra, 2022). Understanding individual PEB and its determinants is one important part of wider efforts towards the protection and restoration of our natural environments.

Pro-environmental behaviours

Although PEB can be broadly described as actions in support of the environment, there is a wide "diversity and dimensionality of pro-environmental actions" (Larson et al., 2015). Larson et al. (2015) divide PEB into four domains:

1. conservation lifestyle behaviours (e.g., household actions in the private sphere)
2. social environmentalism (e.g., peer interactions and group membership)
3. environmental citizenship (e.g., civic engagement in the policy arena)
4. land stewardship (e.g., support for wildlife and habitat conservation)

While the focus of this review is on PEB in its broadest sense (including all four of Larson et al.'s domains), the literature discussed spans a range of PEB. These behaviours have been measured in different contexts, and with a wide geographical spread. For example, some behaviours are specific to certain audiences, such as classroom water consumption practices of teachers in Turkey (Yıldırım and Semiz, 2019); while others are applied across audiences, such as sustainable clothing purchases in multiple countries including the United Kingdom (Joanes et al., 2020). Some behaviours have been of interest for many years, such as home-related actions like recycling and heating practices in the Netherlands (Blok et al., 2014). But other behaviours have only recently become broadly relevant, such as face mask littering in Ghana (Arkorful et al., 2021) and alternative fuel vehicle purchases in Pakistan (Saleem et al., 2021).

Behavioural determinants

To better understand PEB, it is important to unpick the factors (i.e., determinants) that result in more or less PEB. These can be individual behavioural determinants or contextual and structural determinants of PEB. Context and structure may directly affect PEB, but also shape individual emotions and motivations that impact upon behaviour (Steg & Vlek, 2009). For example, availability of public transport to conservation sites may directly increase engagement with conservation activity, but may also increase connection

to nature, and exposure to similar others that reinforce environmental concern, indirectly promoting further conservation behaviour.

The current report focuses on individual behavioural determinants. These determinants are grounded in an individuals' perception of themselves, others, what they feel is important or good, and their personal experiences, among other things. A recently published review by van Valkengoed et al. (2022) provides the most comprehensive summary to-date of individual behavioural determinants of PEB. Table 1 outlines the definition of each determinant as identified by van Valkengoed and/or the papers in this review. All the determinants of PEB considered here are individual behavioural determinants, that can be measured/assessed via individuals.

Table 1. Definitions of determinants of PEB identified by van Valkengoed et al, (2022) and wider literature

Behavioural determinant	Definition
Ascription of responsibility	The extent to which people personally feel responsible for the (negative) environmental consequences of their actions (van Valkengoed et al., 2022).
Attitudes	The degree to which a person positively or negatively evaluates a particular environmental behaviour (van Valkengoed et al., 2022).
Connection to nature	The extent to which humans see themselves as part of nature (Barragan-Jason et al., 2022).
Descriptive norms	The extent to which people believe others engage in a behaviour (van Valkengoed et al., 2022). They may also be referred to as subjective norms in the literature.
Environmental concern	Concern, worry, or fear about environmental problems (van Valkengoed et al., 2022). Sometimes subsumed under attitudes or knowledge.
Environmental self-identity	The extent to which people think of themselves as pro-environmental (van Valkengoed et al., 2022).
Habits	Unconscious routines in behaviour (van Valkengoed et al., 2022).
Injunctive norms	The extent to which people believe a behaviour is commonly approved or disapproved of by people or groups (van Valkengoed et al., 2022).
Knowledge	Understanding of the scientific facts about the causes and impacts of environmental problems (van Valkengoed et al., 2022).
Outcome efficacy	The extent to which people perceive their behaviour as effective in contributing to resolving environmental problems (van Valkengoed et al., 2022). It may also be referred to as response efficacy in the literature.
Personal norms	A person's perceived moral obligation to engage in or abstain from a particular behaviour (van Valkengoed et al., 2022). They may also be referred to as moral norms or moral obligation in the literature.

Behavioural determinant	Definition
Problem awareness	The awareness that performing or not performing a certain behaviour increases environmental problems (van Valkengoed et al., 2022).
Risk perception	An individual's evaluation of the likelihood and severity of a particular environmental hazard (van Valkengoed et al., 2022). Risk perception in this context does not refer to the perceived risk of penalties associated with not complying with a given policy, law, etc. (which is how the term is used in the context of illicit behaviours).
Self-efficacy	The extent to which people feel capable of implementing a specific action (van Valkengoed et al., 2022). It may also be referred to as perceived behavioural control in the literature.
Self-focused emotions	Emotions (often negative) that people feel in response to their own environmental behaviour, including guilt, shame, and pride (van Valkengoed et al., 2022).
Trust	This is inconsistently defined in the literature, but may refer to an individuals' perception that an agency, stakeholder, messenger, policy, etc. is competent, objective, fair, consistent, reliable, and/or caring. It may mean that the subject to be trusted will act ethically and in line with the needs and wants of the individual (Amin and Tarun, 2020; van Valkengoed et al., 2022; Wynveen and Sutton, 2015).
Values	Concepts that transcend specific situations/actions and serve as guiding principles for an individual in their life (Steg, 2016).

Measuring PEB and its determinants

There are a multitude of ways PEB and its determinants can be measured. Lange and Dewitte (2019) provide an overview of the ways in which PEB (but not its determinants) is commonly assessed and detail the benefits and drawbacks of these. Laboratory and field-based observations are discussed as the most objective of these measures, through actual measurement or observation of PEB. Self-reported measures instead can be collected through surveys, interviews, or focus-groups, and gathered data may include quantitative (numerical) or qualitative (non-numerical) information. Such information can be collected through closed-answer questions with predefined answer options that the respondent must select from, or through open-answer questions that allow the respondent to answer in any way they choose. Closed-answer self-reported measures of PEB are the most commonly used measure type in larger scale research, such as national or international surveys due to the ease of data collection and analysis on a large scale.

By necessity, self-reported measures are also most often used when looking at determinants of PEBs due to the focus on subjective experience, including individuals' perception of themselves, others, what they feel is important/good, and their personal experiences. Unlike Lange and Dewitte's (2019) paper on PEB, no reviews were found that bring together insights on the measurement of determinants of PEB.

The current review

Building on the insights of van Valkengoed et al. (2022), the current quick scoping review aimed to identify how PEB and 17 key behavioural determinants of PEB can be measured using closed-answer survey questions. This review is the first to bring together insights on the measurement of PEB and its determinants, providing key recommendations for consistency, accuracy, and ease of measurement. The review aims to inform the measurement of PEB and its determinants within large scale surveys like Natural England's (2020) 'People and Nature Surveys', as well as the use of closed-answer questions within smaller experimental work looking at PEB.

Methods: Quick scoping review

Inclusion and exclusion criteria

This quick scoping review of the literature involved running 17 searches (1 for each behavioural determinant), as well as a supplemental search to ensure the most relevant PEB measurement information was captured. To restrict the scope of the review but obtain the most relevant papers, the following inclusion criteria were applied. Papers must:

1. measure one or more of the 17 determinants of PEB outlined in Table 1
2. use a closed-answer survey whereby the majority of response options do not allow for open-ended response
3. provide enough information on the measurement of one or more of the 17 determinants of PEB to allow for replication of measurement (e.g., all of the scale statement(s) and the scale itself) and at least some reflective/reasoning text regarding the methodology for measuring the determinant;
4. relate to the environmental field (e.g., a study on self-efficacy as a determinant of health behaviour would be excluded)
5. be from a peer-reviewed journal
6. be primary research
7. be published between 2013 and 2023 to capture the last 10 years of research
8. be published in English (papers were not restricted to a certain audience or geographic region)

Search strategy and results

Google Scholar was used to perform the literature search. Google Scholar has a higher search term character limit than many other engines, it is not limited by publisher, country, or language, and it is an ‘all-text’ search, meaning that it will look for the search term anywhere in a publication, not just the title and abstract. To reduce bias due to the authors’ past search history and affiliations, searches were run using an ‘incognito’ window on Google Chrome. Google scholar ranks search results both by relevance to the search terms and factors such as how recently and often a paper is cited (Google, 2023).

Prior to running the full search, multiple test searches were run using variations of the final terms below to test their success in identifying key papers. Four a priori identified papers recommended by experts in the field were used to test the search structure. Three of the four papers were found to be identifiable directly in the Google search results, and one was identifiable indirectly, as the author had other very similar papers display in the search results.

Seventeen separate searches were performed per each determinant. The search terms included:

(Attitudes) AND (Environmental OR Climate)

("Descriptive norms") AND (Environmental OR Climate)
("Injunctive norms") AND (Environmental OR Climate)
("Personal norms") AND (Environmental OR Climate)
(Knowledge) AND (Environmental OR Climate)
("Outcome efficacy") AND (Environmental OR Climate)
("Problem awareness" OR "Awareness of Consequences") AND (Environmental OR Climate)
("Ascription of responsibility") AND (Environmental OR Climate)
("Risk perception") AND (Environmental OR Climate)
("Self-efficacy" OR "personal efficacy") AND (Environmental OR Climate)
(concern OR fear OR anxiety) AND (Environmental OR Climate)
("Self-focused emotions" OR Guilt OR Pride) AND (Environmental OR Climate)
("self-identity" OR identity) AND (Environmental OR Climate)
(Trust) AND (Environmental OR Climate)
(Connected OR Connectedness OR Connection OR Relatedness) AND (Nature)
(Values) AND (Environmental OR Climate)
(Habits) AND (Environmental OR Climate)
To capture papers with survey methods, the above terms were coupled with:
AND (Survey OR Closed-answer OR Questionnaire OR Poll OR Measure)
To capture behaviour related papers, the above terms were coupled with:
AND (Behavio* OR Nudg*)

The top 30 papers listed per determinant were screened. A cap was necessary to allow for rapid review. A cap of 30 produced a wealth of information around relevant measures and began to repeat earlier findings, indicating that a good level of 'thematic saturation' had been reached through this approach.

The review was completed in February 2023. In total, 510 papers were screened, and 177 papers included, all published between 2013 and 2023. These 177 papers captured 624 measurements of the 17 behavioural determinants. Data was collected in 48 countries or country-combinations. 58% of determinant entries were measured offline, 44% were measured online (some were measured both on and offline), and 69% of entries were measured in the context of a behavioural theory.

A total of 98 of the papers found during determinants searches explicitly measured PEB (not just behavioural intent) and an additional search was completed to ensure key review papers relating to the measurement of PEB were captured also. The inclusion criteria for this supplemental search were papers that:

1. discussed the use of closed-answer survey measure to measure PEB
2. were from a peer-reviewed journal
3. were a review (e.g., meta-analysis or narrative)
4. were published between 2013 and 2023 to capture the last 10 years

Search terms included: ("pro-environmental" OR "pro-environmentalism") AND (survey OR closed-answer OR questionnaire OR poll OR measure) AND (review OR "meta-analysis").

Two papers from the first 30 hits were used to inform conclusions drawn around measurement of PEB.

Extraction of information

Information on measuring behavioural determinants and PEB in closed-answer surveys was extracted. This included:

1. Research details e.g., reference, country of implementation and participant group
2. Use of theory e.g., if they were testing a behavioural model, theory or paradigm
3. Survey structure and notes on methodology
4. PEB measurement details
5. Behavioural determinants measured and measurement details, e.g., question format, number of questions, question framing
6. Methods of data analysis
7. observed linkages between determinants and behaviour, if noted

Review insights

This section starts by providing details of specific 'commonly used measures' identified through this review for the assessment of each determinant of PEB. Following this, insights taken from the reviewed papers are summarised around question formats used, analysis practices, and theoretical models and frameworks used within this literature.

Commonly used measures

Using measures collated through the quick scoping review, a list of common measurement approaches for PEB and each of the 17 determinants has been compiled (Table 2). These recommendations aim to support the ease and consistency of surveys that measure these constructs using closed-answer questions. The decision to include each of these measures is based on what format was found most commonly employed and validated by authors, but should not be considered as the 'only' or 'best' measures for use. Judgements of 'best' measurement are dependent on the individual needs of each survey, taking into consideration the needs of the target participant group, as well as the survey and data requirements (see the final section for guidance on making these considerations).

Table 2. Summary of common measurement of PEB and its determinants using closed answer questions

Behavioural determinant	Common question formats
Pro-environmental behaviour	Varies across multi-choice, binary, and scale questions. Ideally, look for a relevant previously validated scale before designing your own, such as Brick et al. (2017), or the General Ecological Behavior (GEB) measure (Kaiser, 2006), or Markle (2013) for 42 different multi-item measures.
Ascription of responsibility	Generally, a 7-point scale with multiple statements, averaged to create a composite variable if internal correlation is sufficient. Ideally, look for a relevant previously validated scale before designing your own, such as De Groot and Steg (2009).
Attitudes	Generally, a 7-point semantic scale with multiple statements, averaged to create a composite variable if internal correlation is sufficient. Ideally, look for a relevant previously validated scale before designing your own, such as Milfont and Duckitt (2010).
Connection to nature	Generally, a 7-point scale with multiple statements such as the Nature Relatedness scale (Lumber et al. 2017), or use the inclusion of Nature in Self (INS) scale (Schultz, 2002).
Descriptive norms	Generally, a 7-point scale with multiple statements, varying the referent (e.g., people like me, friends, colleagues). Consider the relevance of local vs global norms, and dynamic or prospective norms.

Behavioural determinant	Common question formats
Environmental concern	Generally, a 7-point scale with multiple statements, averaged to create a composite variable if internal correlation is sufficient. Ideally, look for a relevant previously validated scale before designing your own, such as Dietz et al. (1998) or Kim and Choi (2005)
Environmental self-identity	Generally, a 7-point scale with multiple statements, averaged to create a composite variable if internal correlation is sufficient. Ideally, look for a relevant previously validated scale before designing your own, such as Whitmarsh and O'Neill (2010).
Habits	Generally, a 7-point scale with multiple statements, averaged to create a composite variable if internal correlation is sufficient. Ideally, look for a relevant previously validated scale before designing your own, such as the SelfReport Habit Index (SRHI; Verplanken and Orbell, 2003).
Injunctive norms	Generally, a 7-point scale with multiple statements, averaged to create a composite variable if internal correlation is sufficient. Ideally, look for a relevant previously validated scale before designing your own, such as Ajzen's validated Theory of Planned Behavior scale (1991).
Knowledge	Generally, either multiple-choice questions to assess actual knowledge, or a 7-point scale with multiple statements to assess perceived knowledge.
Outcome efficacy	Generally, a 7-point scale with multiple statements, averaged to create a composite variable if internal correlation is sufficient. Ideally, look for a relevant previously validated scale before designing your own - see Roser-Renouf and Nisbet (2008) for a review of measures.
Personal norms	Generally, a 7-point scale with multiple statements, averaged to create a composite variable if internal correlation is sufficient. Ideally, look for a relevant previously validated scale before designing your own, such as Schwartz (1975), Dolnicar and Leisch (2008) or Abrahamse et al., (2005).
Problem awareness	Generally, a 7-point scale with multiple statements, averaged to create a composite variable if internal correlation is sufficient. Ideally, look for a relevant previously validated scale before designing your own, such as Steg and de Groot (2010) or Onwezen et al., (2013).
Risk perception	Generally, a 7-point scale with multiple statements, averaged to create a composite variable if internal correlation is sufficient. Ideally, look for a relevant previously validated scale before designing your own, such as the Climate Change Risk Perception Index (Leiserowitz, 2006). Consider the referent - e.g. me, people like me, my city.

Behavioural determinant	Common question formats
Self-efficacy	Generally, a 7-point scale with multiple statements, averaged to create a composite variable if internal correlation is sufficient. Ideally, look for a relevant previously validated scale before designing your own - see Roser-Renouf and Nisbet (2008) for a review of measures.
Self-focused emotions	Generally, a 7-point scale with multiple statements. Ideally, look for a relevant previously validated scale before designing your own, such as Kugler and Jones' (1992) guilt inventory or Tracy and Robins' (2007) authentic pride scale.
Trust	Generally, a 7-point scale with multiple statements. Ideally, look for a relevant previously validated scale before designing your own. Consider the relevance of social vs institutional trust to the subject matter.
Values	Generally, a 7-point scale with multiple statements, averaged to create a composite variable if internal correlation is sufficient. Ideally, look for a relevant previously validated scale before designing your own, such as Schwartz (1992), Steg et al., 2012, or Steg and de Groot (2012).

Question formats

Table 3 provides an overview of the question formats that were used to assess each determinant. More detail on the use of each type of format is given in the following sub-sections.

Table 3. Question formats used in closed-answer surveys to assess PEB and related behavioural determinants identified by the current review. Some cells are left intentionally blank.

	Multiple-choice: 1 answer	Multiple-choice: 1+ answer	Likert scale	Semantic scale	Pictorial Scale	Binary	Ranking	Single question	Multiple questions
Pro-environmental behaviour	X		X			X			X
Ascription of responsibility		X	X				X	X	X
Attitudes			X	X		X		X	X
Connection to nature		X	X		X			X	X
Descriptive norms			X					X	X
Environmental concern			X			X		X	X
Environmental self-identity			X			X			X
Habits			X					X	X
Injunctive norms		X	X					X	X
Knowledge	X		X			X		X	X
Outcome efficacy			X					X	X
Personal norms			X					X	X

	Multiple-choice: 1 answer	Multiple-choice: 1+ answer	Likert scale	Semantic scale	Pictorial Scale	Binary	Ranking	Single question	Multiple questions
Problem awareness	X		X					X	X
Risk perception			X					X	X
Self-efficacy			X					X	X
Self-focused emotions		X	X			X		X	X
Trust			X					X	X
Values			X					X	X

Note: 'X' indicate where question formats have been used in closed-answer surveys to assess PEB and related behavioural determinants. Cells left blank show no evidence of use within articles collected as part of this quick scoping review.

Scale questions

The most used question format was scales. Likert scales were employed to assess every type of determinant and PEB in this review. The number of points along the scale of measures obtained from this review varied from 4 to 10 points, with the most common options being 5-point and 7-point scales. In a Likert scale question, the respondents are presented with one or multiple statement items and then asked to rate their agreement or strength of feeling with each item. For instance, an item from Wang et al. (2016) measuring ascription of responsibility read “I think individuals have the responsibility to protect the environment,” and respondents answered by selecting from a 5-point scale (Strongly disagree - Disagree - Neutral - Agree - Strongly agree). The phrasing of these scales across studies varied, for example: ‘Never - Always’, ‘No concern - Strong concern’, ‘Does not describe me - Describes me very well,’ and ‘Not at all important - Extremely important.’

Another type of scale is the semantic differential scale (also referred to as a bipolar scale). The current review showed that this scale was only used to assess attitudes. In a semantic scale the statement item often references a behaviour, situation, policy, etc. and respondents may be asked to rate this item multiple times across different scales (the summed result of these ratings is then seen as a single attitudinal measure). For example, in Liu et al. (2017) respondents were asked to rate their attitude toward car-transport reduction along four 7-point scales: ‘Harmful - Beneficial’, ‘Disgusting - Pleasant’, ‘Bad - Good’, and ‘Unworthy - Valuable’.

Only one other type of scale was found in this review, a pictorial scale (i.e., visual scale). The Inclusion of Nature in Self (INS) scale is a type of pictorial scale used to assess respondents’ connection to nature (Schultz, 2002). In the INS scale, respondents are shown Venn diagrams with the two circles representing themselves and nature. This 7-point scale has seven images of circles increasing in how much they overlap, ranging from two completely separate circles to fully overlapping circles (see Liefländer et al., 2013, for an example).

Multiple-choice questions

Multiple-choice questions were used to assess PEB as well as injunctive norms, knowledge, problem awareness, ascription of responsibility, connection to nature, and self-focused emotions. Authors used this question format the most when measuring knowledge and PEB. Respondents of multiple-choice questions were either allowed to select only a single answer option (i.e., mutually exclusive answers), or multiple answer options (i.e., non-mutually exclusive answers). For example, Libarkin et al. (2018) ascertained respondent knowledge by asking questions such as “What do greenhouse gases do as part of the greenhouse effect?” and having respondents select one of four answers, while Zhu et al. (2019) assessed injunctive norms by asking respondents "What do those who are important to you expect of you in relation to participating in smog reduction behavior?’’ and having them select any and all of four answers.

Binary questions

Questions with binary answer options (Yes/No or True/False) were used to assess PEB as well as attitudes, knowledge, environmental concern, self-focused emotions, and environmental self-identity. Similar to multiple-choice questions, authors used this format the most when measuring knowledge and PEB. For example, Roczen et al., (2014) assessed attitudes by asking respondents to answer Yes/No on 23 items such as “I get up early to watch the sunrise.” In this study the authors also used Likert scales to assess attitudes.

Ranking questions

There was one ranking question found in the review. Zeng et al. (2020) assessed ascription of responsibility by first asking respondents “Who should take the responsibility for environmental protection?” via a multiple-choice question with multiple answer options. They then asked respondents to rearrange the answer options in order of who they think is most responsible for environmental protection (e.g., 1. Government, 2. Every individual, 3. Business enterprises, and 4. Others). This approach was a creative closed-answer way to gain nuance in respondents’ ascription of responsibility without the need for an open-ended question.

Data analysis

All studies in the review conducted both descriptive and advanced statistical analyses (e.g., regressions). Like in Wynveen and Sutton (2015), many studies with Likert scales began their analyses “by computing descriptive statistics for each variable and calculating a Cronbach's alpha for each scale as an indicator of the scale's internal consistency [sometimes referred to as the scale’s reliability].” Authors also often conducted a confirmatory factor analysis to assess the scale’s validity. Rodriguez–Sanchez et al., (2020) states: “...the measurement model was estimated, and reliability and validity were assessed, with confirmatory factor analysis (CFA).” Sometimes an exploratory factor analysis (EFA) was also performed before the CFA to “identify and validate the items contributing to each component” (Kumar and Ghodeswar, 2015). See Suhr (2006) for a white paper on the difference between an EFA and CFA.

For Likert scales in particular, it can be useful to begin with preliminary data visualisation, such as histograms, to check for the presence of ceiling or floor effects (i.e., an overabundance of respondents choosing the top or bottom answer option). These effects can increase bias and uncertainty in the results,and may mean the data needs to be transformed (Šimkovic & Träuble, 2019). Generally single Likert items should be treated as ordinal data, but if multiple items are combined into a scale they can be treated as continuous for the analysis (Harpe, 2015).

By far the most popular method used across studies to "verify the proposed research framework and evaluate the proposed hypothesis paths between and among the

respective constructs," was using structural equation modelling (SEM) (Arkorful et al., 2021). According to Arkorful, SEM can effectively "(a) evaluate a series of direct and indirect relationships within a model simultaneously; (b) examine relationships between latent and observed variables; (c) examine latent variables by utilising a cluster of indicators while testing their hypothesis at construct levels; and (d) provide precise measurements by modelling random errors in observed variables."

Diaz-Ruiz et al., (2017) states that:

"There are two types of SEM, the covariance-based SEM (CBSEM) and the variance-based (PLS-SEM). The former is applied to confirm or reject solid theories by estimating the covariance matrix of the data. The latter is primarily applied in exploratory research to develop new or on early stages theories looking into the variance in the dependent variables… PLS intends to test how the theory fits the data, the fit of the model in PLS-SEM test the discrepancy between the observed values and the values predicted by the model in question. The objective of PLS is to maximise the variance explained rather than the fit."

This PLS-SEM (i.e., Partial Least Squares - SEM) method was more popular than the CBSEM among authors in the review.

A range of other analysis approaches were also used to assess results across question formats, such as additional regression-based methods (e.g., Campbell et al., 2023), analysis of variance tests (e.g., Wang et al., 2016), t-tests (e.g., Lacasse, 2016), chi-squared tests (e.g., Giampietri et al., 2017), and Pearson's correlation tests (e.g., Heidari et al., 2019).

Theoretical basis

The behavioural models and theoretical frameworks that were cited within reviewed papers provide an insightful picture of where determinants sit within wider thinking around PEB. Each determinant and the behavioural models and/or theoretical frameworks it has been related to are summarised in Table 4.

Table 4. Determinants of PEB identified by van Valkengoed et al, (2022) and their inclusion in behavioural models/theories

Behavioural determinant	Theoretical basis
Ascription of responsibility	Ascription of responsibility is often assessed in the context of the norm activation model and the value belief norm theory. Papers were also identified that measured ascription of responsibility in the context of theories such as the theory of green purchase behaviour (Han, 2020), the comprehensive action determination model (Joanes et al., 2020), and the theory of planned behaviour (Heidari et al., 2019). It should be noted that across behavioural determinants and PEB, the theory of planned

Behavioural determinant	Theoretical basis
	behaviour (or similar) and the norm activation model were often employed together (e.g., Liu et al., 2017).
Attitudes	Attitudes are often assessed in the context of the theory of planned behaviour and related theories. Papers were also identified that measured attitudes in the context of theories such as the comprehensive action determination model (Joanes et al., 2020), the value belief norm theory (Wang et al., 2020), and the new model of green consumer behaviour (Paço et al., 2019).
Connection to nature	In the papers reviewed here, connection to nature was assessed in the context of theories such as the sustainable consumption behaviour theory (Wang et al., 2013) and the biophilia hypothesis (Lumber et al., 2017).
Descriptive norms	Descriptive norms are often assessed in the context of the focus theory of normative conduct. Papers were also identified that measured descriptive norms in the context of theories such as the norm activation model and theory of planned behaviour (Onwezen et al., 2013), theory of interpersonal behaviour (Issock et al., 2020), and the model of goal directed behaviour (Passafaro et al., 2014).
Environmental concern	Environmental concern is often assessed in the context of the protection motivation theory. Papers were also identified that measured environmental concern in the context of theories such as the norm activation model (Confente and Scarpi, 2020), the extended theory of planned behaviour (Chen and Tung, 2014), and the model of environmentally responsible behaviour (Pan et al., 2018).
Environmental self-identity	Environmental self-identity is often assessed in the context of the value identity personal norm model. Papers were also identified that measured environmental self-identity in the context of theories such as the theory of reasoned action (Shang and Wu, 2022), and the norm activation model and value belief norm theory (Perera et al., 2022).
Habits	In the papers reviewed here it was assessed in the context of theories such as the habit discontinuity hypothesis (Verplanken and Roy, 2016), the theory of planned behaviour, the theory of interpersonal behaviour, and the comprehensive model of environmental behaviour (Russell et al., 2015).
Injunctive norms	Injunctive norms are often assessed in the context of theories such as the theory of planned behaviour and the focus theory of normative conduct. Papers were also identified that measured injunctive norms in the context of the theory of normative social behaviour (Borg et al., 2020), the moral foundation theory (Jansson and Dorrepaal, 2015), and the value social norm enjoyment-based motivation model (Ahn et al., 2020).
Knowledge	Knowledge is often assessed in the context of theories such as the knowledge deficit model. Papers were also identified that measured knowledge in the context of the theory of planned behaviour (Suki and Suki, 2014), the ability, motivation, and opportunity theory (Fawehinmi et al., 2019), and the value belief norm theory (Wang et al., 2020).
Outcome efficacy	Outcome efficacy is often assessed in the context of theories such as the norm activation model, the value belief norm theory, and the protection motivation theory. Papers were also identified that measured outcome efficacy in the context of the comprehensive action determination model

Behavioural determinant	Theoretical basis
	(Joanes et al., 2020) and the extended model of planned behaviour (Kang et al., 2013).
Personal norms	Personal norms are often assessed in the context of theories such as the norm activation model, the value belief norm theory, and the value identity personal norm model. Papers were also identified that measured personal norms in the context of theories such as the theory of planned behaviour (Hongyun et al., 2020), the moral foundations theory (Jansson and Dorrepaal, 2015), the theory of interpersonal behaviour and the focus theory of normative conduct (Issock et al., 2020).
Problem awareness	Problem awareness is often assessed in the context of theories such as the norm activation model and the value belief norm theory. Papers were also identified that measured problem awareness in the context of the theory of planned behaviour (Hongyun et al., 2020), the theory of green purchase behaviour (Han, 2020), and the comprehensive action determination model (Joanes et al., 2020).
Risk perception	Risk perception is often assessed in the context of the protection motivation theory. Papers were also identified that measured risk perception in the context of theories such as the theory of planned behaviour (Zhu et al., 2019), the cognitive theory of stress model (Chen, 2015), and the value belief norm theory (Liobikien and Juknys, 2015).
Self-efficacy	Self-efficacy is often assessed in the context of the theory of planned behaviour and the protection motivation theory. Papers were also identified that measured self-efficacy in the context of theories such as the norm activation model (Ataei et al., 2022), the value belief norm theory (Wynveen and Sutton, 2015), and the model of private proactive adaptation to climate change (Burnham and Ma, 2016).
Self-focused emotions	Self-focused emotions are often assessed in the context of the norm activation model and the value belief norm theory. Papers were also identified that measured self-focused emotions in the context of theories such as the cognitive theory of stress model (Chen, 2015), the theory of interpersonal behaviour (Issock et al., 2020), and the theory of planned behaviour (Nguyen et al., 2017).
Trust	In the current review, trust was assessed in the context of theories such as the value belief norm theory (Arbuckle et al., 2015), theory of planned behaviour (Sultan et al., 2019), the rational choice theory, and the subjective expected utility theory (Wheeler et al, 2019).
Values	In the current review, values were assessed in the context of theories such as the value belief norm theory (Yıldırım and Semiz, 2019), the theory of reasoned action (Khare, 2015), the new model of green consumer behaviour (Paço et al., 2019), and the value social norm enjoyment-based motivation model (Ahn et al., 2020).

Considerations for the measurement of PEB and its determinants

Insights from discourse beyond the reviewed papers are used here to critically discuss the use of closed question formats for the measurement of PEB and its determinants, highlighting key design considerations that should be made when using closed question formats, and common biases that should be considered and mitigated against.

With these considerations in mind, it is crucial to carefully craft how the survey overall is presented to respondents, and how each question and answer is framed/phrased and ordered. Beyond this summary, there is a wealth of literature implementers can consult. See for example de Bruin's (2010) chapter detailing framing effects to consider when designing survey questions, or Althubaiti (2016) for more on response biases like recall and social desirability bias, as well as how to mitigate these effects. When developing scale questions, see Jebb et al., (2021) and Boateng et al., (2018) for Likert-specific advice (with many principles relating to other question formats).

Validation of measures with different participant groups

In the review three main question-development tactics were identified as informing the design and appropriateness of survey questions: 1) using validated scales, 2) piloting, and 3) consulting experts.

In 76% of the determinant entries from the current review, authors stated that they relied on past research, whereby scales had been previously validated by other authors. Using existing validated measures published in peer-reviewed journals offers greater confidence that a survey is measuring what it intends to measure. Table 2 provides references for a range of validated measures used to look at PEB and its determinants. However, validated measures may not always have been validated in the specific contexts and with the specific participant group needed for a new piece of research. In this case, further piloting and expert guidance (from literature, professionals or the user group) can ensure that validated measures are suitable for use in the new context.

In 28% of entries, authors piloted/pre-tested measures with their participant group and 14% of articles reviewed noted that they made use of a panel of experts to inform survey design. One example, Pagiaslis and Krontalis (2014) used existing literature to develop a survey draft which was reviewed by a panel of five experts in consumer research and biofuels, then a resulting questionnaire was piloted with 150 consumers before the final survey was rolled out.

Contextualising research for a specific audience is particularly vital when that audience includes a new group expected to have a different level of understanding. Survey implementers must consider, and test, whether their question and answer options are relevant to their participant group and how these respondents will interpret the framing/phrasing. For example, nine studies in the current review involved child

respondents (under 18 years old), and although most of the authors likely considered their audience, only Wallis and Loy (2021) explained the survey adjustments they made for their respondents: "Based on studies with adolescents and young people… we asked for social influences in the form of the perceived pro-environmental activism of their parents (H2a) and friends (H2b)." Beyond this, Farage et al., (2021) adapted their approach based on participant background which they believed would influence literacy level and previous experience with surveys. They used a 4-point scale represented visually as 4 circles of varying colour. The answer options were also written on each circle (i.e., dark green with 'Strong agreement' written; light green with 'Agreement'; dark red with 'Strong disagreement'; light red with 'Disagreement'). Respondents could then point to the circle they wished to select.

If translation work was necessary in a study, then authors often enlist multi-stage approaches to achieve a survey that truly conveys the same concepts in the new language and culture. Nguyen et al., (2016), for example, used a prescribed back-translation technique involving two professional translators in English and Vietnamese, followed by a review from two other bilingual researchers, proceeded by an expert panel review and in-depth consumer interviews, all prior to implementing their final survey. See Niamir et al., (2020) for another example of using all three question-development tactics and translation steps.

Cognitive burden/non-response bias and data needs

Considering cognitive burden when choosing survey questions is important, both for participant welfare and to reduce non-response bias. Non-response bias may occur when a survey is not capturing the behaviours and perceptions of those who are unwilling or apathetic to participate (Davern, 2013). Incomplete surveys, or half-hearted answers, can result from a survey placing too much cognitive burden on a respondent, causing them to lose interest or get overwhelmed (i.e., causing cognitive fatigue). Trying to minimise cognitive burden is especially important for children or groups with cognitive disability, as well as for groups who are underrepresented in surveys and whose responses will improve the representation of diverse voices. As such, the level of questioning should represent the balance between data needs and appropriate participant burden.

At a very basic level, the following measures should be taken: 1) identifying key research questions and intended outputs will guide what minimum measures are needed, and 2) scoping of validated 'short version' measures that would reduce numbers of questions.

Scales are widely used due to the nuance they provide in responses. They not only show a respondent's agreement/disagreement with a question/item, but also the extent of that agreement/disagreement. The detail provided by scales is valuable for showing variability in responses but it can also add cognitive burden to respondents. There has been extensive debate in the literature as to what length of scale is better, but 7-point scales may be preferable for measuring attitude-like constructs as they reduce the psychological distance between points on the scale and provide more granularity in the data for the

analysis without overwhelming respondents with a larger scale (Joshi et al., 2015; Wakita et al., 2011).

Binary questions were only seen in three studies within this review, as authors more commonly formatted their Yes/No questions as multiple-choice. For example, when assessing PEB, Vesely and Klöckner (2017) asked respondents whether or not they performed a certain behaviour, and repeated this question 56 times for different behaviours. These authors could have flipped the format and instead asked respondents a single multiple-choice question in which respondents could select any behaviours they do perform. A benefit of asking many Yes/No questions is that it produces binary data that is directly usable in statistical software, and it may encourage respondents to think specifically about each behaviour. However, the benefit of transposing the format into one multiple-choice question is that it likely reduces cognitive burden on the respondent and potentially gives more accurate answers since respondents can select fewer behaviours without feeling the 'guilt' of answering many questions with a 'no' or switching back and forth between 'yes' and 'no' (which relates to respondents' internal desire to feel consistent in their behaviours; see Vesely and Klöckner, 2017).

Finally ranked questions are again less cognitively burdensome, but provide very different data outcomes to scale and binary/multiple-choice questions. This is where minimising cognitive burden to participants should be considered alongside the minimal data needs to ensure the data is useful/meaningful. Only scale questions provide detail on the extent to which items/statements are agreed or disagreed with, providing greater variability in responses (e.g., not just whether people do/do not take part in environmental protests, but also how frequently they do this). Additionally, only scale and rank questions can provide comparison or indication of people's prioritisation of different response options (e.g., not just whether people do/do not take part in environmental protests, but also whether they do this more often than other environmental actions).

Additionally, survey implementers should also consider how the respondent will physically respond to surveys to minimise cognitive burden. Blasius (2012) found for rank questions in web surveys, that a 'drag and drop' user-interface performed better than a 'numbering', 'arrows', or 'most–least' interface, at increasing substantive answers and reducing rates of dropouts and non-responses.

Social desirability and recall biases

Self-reported answers are inherently biased as they are subject to the respondent's perspective, memory, and intention to convey a certain image of themselves (Althubaiti, 2016). A key driver of self-reporting bias in environmental studies is the issue of social desirability (Rodriguez–Sanchez et al., 2020). Social desirability bias occurs when respondents (consciously or subconsciously) modify their responses to match what they think the surveyor wants to hear. It results from humans' inherent tendency to want to appear 'socially desirable.' Measures of PEB and other attitudes and behaviours positively framed within the public space are especially prone to this bias. In addition, humans have

faulty memories and often recall their own behaviour inaccurately even when attempting to be accurate, known as ‘recall bias’ (Althubaiti, 2016).

To help mitigate against social desirability bias, respondents should be informed about the anonymity and confidentiality of their responses, and that there are no right or wrong answers (Esfandiar et al., 2019). The way questions are framed/phrased can also greatly affect both social desirability and recall bias. Leviston and Uren (2020), for example, discuss how self-reported loosely specified behaviours (e.g., ‘changing’ one’s gardening practices) are more prone to socially desirable responding than more concrete behaviours (e.g., installing a rainwater tank or insulation). The use of indirect questions (i.e., sensitive questioning techniques) may also be beneficial to reduce the need to respond in a socially desirable way if appropriate in the study context (Koller et al., 2013; Nuno and St. John, 2014).

In reviewed articles, 89% of authors using scale questions included multi-item measurements for a given determinant. This is likely to be because having multiple items allows for cross-validation of results and decreases the likelihood that any one item will skew results inaccurately (e.g., if respondents interpret an item differently to the implementers’ intention). Further, since most items are intrinsically positively or negatively framed, authors can reduce bias by including items that are framed from opposing directions (such items are then ‘reverse coded’). For instance, Lacasse (2016) included both of the following statements among their items measuring environmental concern: “I am concerned about the potential negative impacts of climate change,” and “I am not really worried about climate change.” Reverse-coded items both reduce social desirability bias, and directly increase the likelihood of capturing a respondent’s ‘true’ perspective, since a respondent should answer opposingly on such statements if they do in fact feel a certain way.

Order effects

Another aspect of survey design that can influence respondents’ answers are order effects, whereby the way that questions and response options are ordered have a systematic impact on responses given, leading to bias (Lacroix and Gifford, 2017).

Priming is one example of an order effect arising from question order across a survey (Hjortskov, 2017). For example, if surveyors ask questions about the respondent’s child and then ask questions about their views on environmental protection (e.g., their personal norms), the respondent may now be primed to think about their child and answer the follow-up questions with a greater focus on the legacy impacts of their behaviour on future generations. The possibility of priming on responding should therefore be considered and questions re-ordered to minimise impacts.

For multi-item measurements for a given determinant, especially when including reverse-coded items, it is useful to mix the order of statements so that not all positive/pro-environmental statements come first or last.

Other order effects can occur within a questions' response options, such as with multiple choice or ranked questions (Serenkoa and Bontis, 2013). With longer lists, primacy and recency effects as part of the 'serial position effect' can cause respondents to focus on the first and last answer option in a list (Murdock, 1962). And when looking for a 'right' answer, respondents also tend to look to the middle answer option (e.g., option 'C'), particularly if they are unsure (Attali and Bar-Hillel, 2003). As such, randomising answers would reduce biases arising from order.

Participant choice vs. completeness of data

A final important consideration when designing a survey is how much flexibility to give respondents to not make a choice or respond neutrally to questions. Survey respondents should always be free to withdraw from a survey, but the availability of responses that allow a more neutral response is a decision made by the researcher. By providing greater flexibility to not answer questions (and remain in the survey) or respond neutrally, participant retention may be greater, however this may affect the completeness of data and allow for more socially desirable responding. The cases of scale mid-points and 'don't know/prefer not to say' options (or similar) are discussed here as examples.

It is worth noting that despite the proliferation of odd numbered scales, having a mid-point/neutral option may not always be the best approach. Taufique et al. (2016) for example, specifically used a 4-point scale to encourage respondents "to choose a positive or negative response to minimise social desirability bias," and because "the omission of a midpoint is particularly useful when dealing with Asian respondents, who often have a higher mid-range response tendency." See Chyung et al. (2017) for an often-cited resource on determining whether to use a midpoint in a scale.

A major consideration for binary questions as well as other question formats, is whether to include an 'I don't know' or 'Prefer not to say' option. In 7 of 14 studies using binary scales within this review, the authors did include such an option. Both Bolderdijk et al., (2013) and Ünal et al. (2018) stated that they included an 'I don't know' option in their True/False questions to prevent respondents from guessing the right answer, thereby enabling the authors to more accurately assess respondents' knowledge of PEB. To assess self-focused emotions, Hickman et al., (2021) asked the question "Does climate change make you feel any of the following?" accompanied by a list of 14 emotions (e.g., helpless, ashamed), and respondents answered 'Yes/No/Prefer not to say' to each emotion. This third option gave respondents the ability to opt out of answering instead of forcing them to inaccurately label themselves. However, this opt-out depends on what the authors aim to assess and how their respondents tend to answer. For instance, if the authors want to encourage respondents to make a choice or state whether they perform a certain behaviour (such as picking up litter), then having an opt-out answer may be counterproductive. Additionally, data from 'opt out' options is often treated as missing (though sometimes it is grouped with 'No/False') thereby increasing missing data and not providing any understanding of why the respondents could not respond in line with the binary options.

Summary of key considerations

The insights from this review have been summarised as key factors to take into consideration when choosing and/or designing closed answer surveys for the measurement of PEB and its determinants:

Use measures validated for a given participant group: To ensure questions are appropriate for the measurement of PEB/determinants for a given target audience, surveyors should use measures validated with that group. Where none are available, existing questions could be tested and validated with the target group, or new questions developed. The development of new questions should consider existing literature, consult experts in the field, and pilot and validate measures appropriately before use. Piloting how questions are interpreted is particularly important when studying a new group with possible differences in understanding (e.g., children or those with cognitive disabilities).

Balance reducing cognitive burden/non-response bias and meeting data needs: Considering cognitive burden when choosing survey questions is important, both for participant welfare and to reduce non-response bias. Non-response bias is when the views of those who are less willing to participate are therefore underrepresented. Trying to minimise cognitive burden is especially important for children, those typically less engaged with research, or groups with cognitive disability. You might do this by:

- *Considering first how the data will be used/analysed and the outputs that are needed from this data,* drawing from this the minimum insights you aim to achieve from questioning and informing the detail of questioning needed;
- *Minimising both the number and complexity of response options* e.g., by using multiple choice rather than multiple scale questions, or shorter scales;
- *Considering the impact of survey format* on ease of responding e.g., online surveys might use drag and drop options for ranking questions, or scale sliders for scale questions.

Reduce social desirability and recall biases: Social desirability bias occurs when respondents (consciously or subconsciously) modify their responses to match what they think the surveyor wants to hear. Recall bias can occur when people are asked to recall/report on previous behaviours but are unable to do this accurately. To help mitigate against these biases, survey designers can:

- Ensure *anonymity and confidentiality of responses;*
- *Ask about concrete behaviours/action* where possible;
- *Use multiple and reverse coded items* - including multiple items that are framed from opposing directions can reduce social desirability bias and corroborate the responder's 'true' response;
- *Validate or use validated measures that have tested a given phrasing/timeframe for recall* for the specific behaviour and/or audience in question e.g., the past week versus the past month, or using a temporal landmark (e.g., 'since Christmas have you…').

Mitigate against order effects: the way that questions and within answer options are ordered can affect responses in a systematic way that biases conclusions drawn. Order effects that should be considered include:

- Consider how *proceeding questions may 'prime' respondents* into thinking about a certain topic when answering later questions (related to social desirability bias) and mitigate against this where possible through re-ordering;
- Within multiple choice answer options, consider *primacy and recency effects* which cause respondents to focus on the first and last answer option in a list. Broadly it is good practice within answer options, to *randomise positively and negatively phrased items/options*;
- When looking for a 'right' answer, respondents tend to look to the *middle answer option* (e.g., option 'C'), particularly if they are unsure. Again, randomisation may reduce this order effect.

Balancing participant choice and completeness of data: survey respondents should always be free to withdraw from a survey, but the availability of responses that allow a more neutral response may affect the balance achieved between completeness of data (including mitigation against social desirability bias) and retention of participants. Two examples are:

- Including a *'don't know'* or *'prefer not to say'* type answer option- Having one can allow respondents to opt out of answering if they are unsure or uncomfortable and so may increase retention of participants, but not having one can encourage respondents to make a choice, thereby reducing passive and opt-out responses.
- *Scale mid-points* – not allowing mid-range responding (e.g., 6-point scale) can reduce social desirability bias by encouraging a response either in favour/against a statement, but including a mid-point (e.g., 7-point scale) may improve response rates and provides an option for those who do not agree or disagree.

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