Measuring environmental behavior using the *Carbon Emission Task*: Some lessons from our file drawer

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1 Behavioral Tasks for Environmental Psychology

When we began our first attempt to contribute something to environmental psychology, we were in search of a dependent variable to study actual environmental behavior (Wyss et al., 2022). The search for a behavioral dependent variable ended with us deriving our own task, the Carbon Emission Task (CET) (Berger & Wyss, 2021). The CET is a simple protocol to measure pro-environmental behavior. It attaches actual environmental consequences to quite artificial choices in the laboratory. Participants make repeated decisions between two options. Option A yields a monetary gain, but also triggers and environmental externality in the form of a carbon emission. Option B, contrarily, does not bring any money to the participant, but neither harms the environment. Varying both personal incentives and environmental consequences in a within-person experimental design allows researchers to test the hypothesis that people are sensitive to both personal benefits as well as environmental harms. In addition, average behavior across trials can be seen as a person's environmental stance, or to infer their environmental attitude (Kaiser & Lange, 2021).

Slightly prior to our own thoughts about a behavioral paradigm, others have derived behavioral tasks to study pro-environmental behavior using actual and consequential behavior (Lange, 2022; Lange et al., 2018; Lange & Dewitte, 2021). As parallel calls for "more behavior" in environmental psychological research have been made (Lange et al., 2023), we write this Opinion in the expectation that interest in and the use of behavioral tasks may increase in the next years. Our work intends to share some of the lessons that occurred along our own path while collecting data from about 10,000 participants (i.e., about 200,000 decisions). We write about things that typically do not make it into papers – if you want, it can be called lessons from our "file-drawer".

2 Behavior is sensitive to costs and rewards (almost) every single time…

Behavior routinely depends on associated costs and environmental benefits: the more financially attractive an option and/or the lower the CO_2 emissions attached to it, the more pro-environmental decisions we observe. In fact, in all studies we have ever conducted, the behavioral pattern looks much like in the validation paper (Berger & Wyss, 2021), no matter if we play 10, 15, or 25 trials, or if we attach trivial or significant amounts of money or CO_2. Thus far, we have only had one big exception. When we recruited students and their parents in a high school near Bern, we found behavior to be particularly insensitive against the within-person manipulation. Carbon neutral bonuses were readily reaped, but any bonus that attached even trivial amounts of CO_2 was foregone. Thus, it seemed that many students and their parents were unwilling to accept the monetary bonus almost irrespective of the environmental consequences, no matter how small they were. Noteworthy, the results in this study inspired us to run our "coherent arbitrariness" study, in which we report results on scope-insensitivity of pro-environmental behavior (Berger & Bregulla, 2023). Quite intriguingly, the high school was located in a rather affluent area with its corresponding emission-intensive lifestyles, so it could practically not have been the case that these participants were truly unwilling to emit CO_2 in their lives. Future research could investigate this disconnect between abstract behavior, which may make it relatively easier to behave in line with one's environmental values, compared to making behavioral changes in locked-in lifestyles.

3 … but is this an experimental artefact?

A question that remains is whether cost and reward sensitivity is an experimental artefact (e.g., resulting from consistency bias) or not (i.e., reflecting actual preferences). We have previously made the argument that the experimental protocol could render consistency motives rather salient and thereby artificially create a behavioral pattern that we may also interpret as being "cost-sensitive" (Berger & Bregulla, 2023). To illustrate, if a person is willing to forego a bonus of 1 dollar to save 20 lbs. of CO_2 from being emitted, this person should subsequently agree to forego a bonus of 50 cents for the same amount of CO_2 by both consistency motives or cost-sensitivity. What speaks against the mere consistency motive are results obtained in other research on related tasks (Lange & Dewitte, 2023; Lange & Iwasaki, 2020). There, researchers find that behavior is also cost-sensitive in a between-person design that does not allow for consistency motives to drive the effects. Our own results on "coherent arbitrariness" are somewhat contrary, but future research could systematically investigate the degree to which consistency versus cost-sensitivity explain behavioral results in the differential experimental paradigms. Our hypothesis is that scope-insensitivity may occur particularly when CO_2 amounts are manipulated, rather than variables with which participants have more experience (time, effort, etc.). However, the within-person variation is high in external validity, we believe. Our basic reality of life is that behavior change happens against the backdrop of our own past behavior. In other words, individuals who display a strong tendency to behave in a way that aligns with their past decisions in their daily lives are also expected to show corresponding decision patterns in the Carbon Emission Task, and vice versa.

4 An "accidental" finding: pro-environmental behavior correlates more strongly with environmental values when Option B also yields a minor environmental harm

A year ago, we ran a classical "failed" study, in which the pre-registered effect did not emerge. Time constraints have prevented us from writing the project up as a study that did not work. In our "failed" study, an interesting exploratory result emerged nevertheless. Remember that in the original CET, the decision trade-off is between reaping money while tolerating an emission and foregoing the money while staying carbon *neutral*. In this study, we did an interesting twitch. Rather than making CO_2 zero in Option B, we just reduced the emission to almost, but not quite zero. Our hypothesis was that the ability to become climate *neutral* (as in the standard CET) could increase pro-environmental behavior relative to the control condition, which attached a tiny emission to Option B. The hoped-for result did not emerge. However, we found that the correlation between our measured environmental construct – in this case biospheric values – and pro-environmental behavior was stronger when Option B yielded a minor environmental harm. Note that the CET, just like the Pro-Environmental Behavior Task (Lange et al., 2018) make the environmentally friendly option climate-*neutral*, rather than just climate-*better*. Potentially, this may in parts undermine external validity, as we are often interested in investigating behavioral changes that are climate-better (e.g., flying less, eating less meat, taking shorter showers, etc.). So, re-interpreting behavioral tasks as having to choose between a relatively more climate friendly option that comes with fewer personal benefits or an option that is less climate friendly but with higher personal benefits could be an interesting generalization of behavioral tasks.

To sum up, we hope that our thoughts help researchers to consider relying on behavioral tasks in their experimental designs, to be confident in making required changes to experimental protocols, and to "experiment around" with behavior. Through some of our "failed" experiments, we have conceived research ideas that we did follow up on and that later provided interesting results. We hope that our work on relatively abstract behavioral tasks helps our community to put more emphasis on behavioral measures.

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