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PERSPECTIVE

Psychological obstacles to the efficacy of environmental footprint tools

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The complexity of many everyday life situations makes decisions difficult. Environmentally conscious individuals do what they can to limit their environmental burden (Kaiser and Shimoda 1999) but being 'environmentally friendly' is not easy without the help of reliable external cues to guide decision making. Labels such as 'organically produced', the 'European Union Ecolabel', the 'Nordic Swan' and other environmental footprint tools serve the purpose of guiding consumer behavior and making people aware of the relation between their resource consumption and the environmental impact of those choices. However, human decision making relies somewhat upon simple rules of thumb called heuristics, partly because these can be used in numerous settings, are memorable, and can be adhered to over time (Gigerenzer and Gaissmaier 2011). While heuristics can yield accurate assessments of the true nature of things, when used inappropriately, they can also lead to systematic biases in the human cognitive system. For example, people tend to overestimate their climate knowledge (Thaller and Brudermann 2020), they believe more strongly in global warming on hot days (Joireman *et al* 2010) and tend to think that larger appliances consume more energy than smaller ones (Cowen and Gatersleben 2017). Biases can be affective and cognitive, arising from both automatic and rapid intuitive processes as well as conscious, reflective and analytical processes (Evans 2018). This paper summarizes and discusses recent research on how cognitive biases prevent environmental footprint tools from reaching their full potential. The paper begins with an overview of empirical findings suggesting that people in some situations perceive consumption levels to go down while, in reality, absolute consumption levels go up. This is followed by a brief discussion of the theoretical explanation of this phenomenon. The paper ends with directions for the development of environmental footprint tools and related policy implications.

Consumers tend to misjudge the environmental impact of labeled products and choices, especially when these products and choices are combined with other products and choices—a phenomenon called a 'negative footprint illusion' (Weijters Gorissen and 2016, Kim and Schuldt 2018; Holmgren *et al* 2018a, 2018b, Kusch and Fiebelkorn 2019, MacCutcheon *et al* 2020). Consider the environmental burden from red meat consumption, widely regarded as one of the most impactful sources (Wynes and Nicholas 2017). Evidence suggests that people intuitively think that the carbon footprint for red meat combined with a side dish labeled 'eco-friendly' is lower than for the red meat alone, possibly believing that the low carbon footprint side dish somehow compensates for the environmental burden of the main course (Gorissen and Weijters 2016). Likewise, people tend to believe that fewer trees are required to compensate for a set comprising regular and energy efficient buildings compared with only the regular buildings (figure 1; Holmgren *et al* 2018b). Even if people have a reasonably good understanding of the difference between a regular and a hybrid car with regard to the vehicles' environmental cost, they intuitively think that adding hybrid cars to an existing car pool does not add to the pool's total environmental burden (Kim and Schuldt 2018). To some extent, there seems to be a 'quantity insensitivity' in perceived environmental burden from consumer choices when those choices are attributed a low environmental footprint (Kusch and Fiebelkorn 2019).

Even though consumers may achieve good understanding of the environmental impact of individual products and services from environmental footprint labels, these examples illustrate that consumers systematically misinterpret bundles of individually

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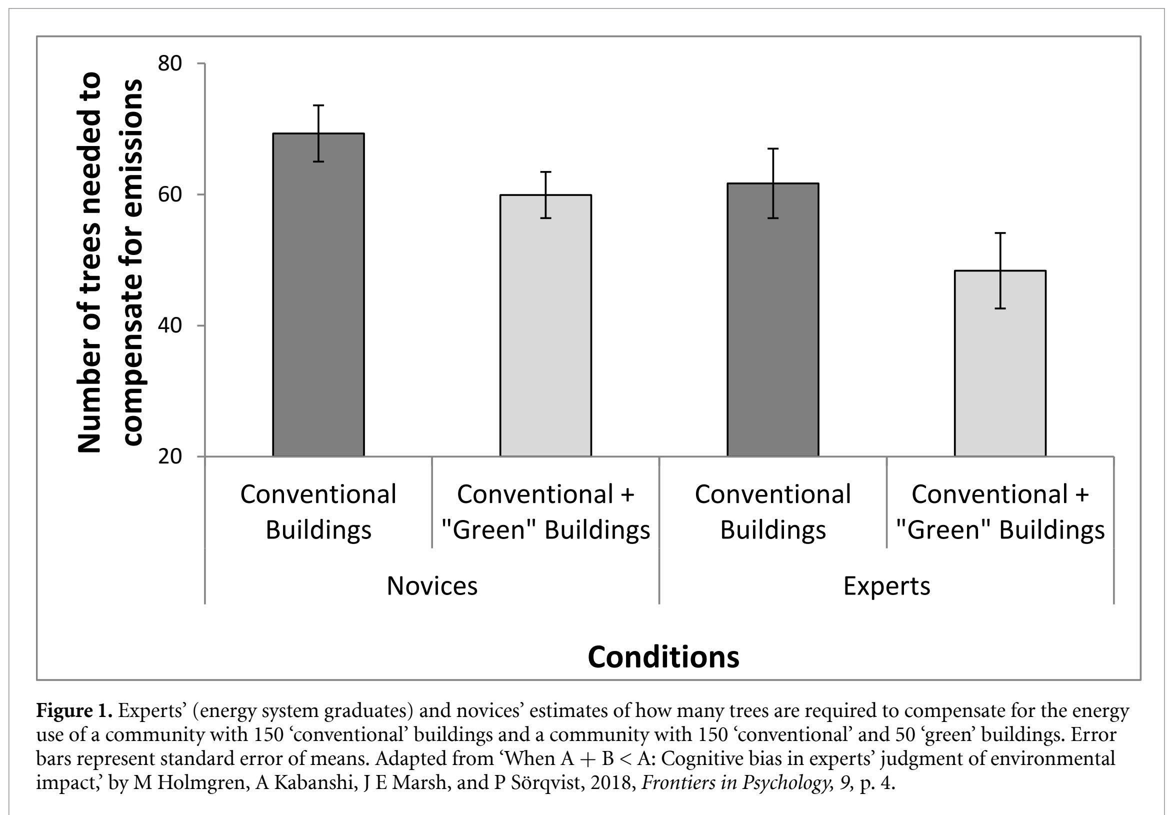

Figure 1. Experts' (energy system graduates) and novices' estimates of how many trees are required to compensate for the energy use of a community with 150 'conventional' buildings and a community with 150 'conventional' and 50 'green' buildings. Error bars represent standard error of means. Adapted from 'When A + B < A: Cognitive bias in experts' judgment of environmental impact,' by M Holmgren, A Kabanshi, J E Marsh, and P Sörqvist, 2018, *Frontiers in Psychology, 9*, p. 4.

labeled services and products. Evidence suggests that people tend to think that environmentally friendlier options compensate for the environmental burden of more harmful alternatives. It has been shown that people often rationalize environmentally harmful actions by pointing out other things they do that are better for the environment (Hope *et al* 2018) and individual differences in these compensatory green beliefs are related to individual differences in susceptibility to the negative footprint illusion (MacCutcheon *et al* 2020). Environmental footprint tools help consumers identify environmentally friendly options over less friendly alternatives. Yet, evidence seems to suggest that environmental footprint tools can also misguide decisions in more complex situations, such as when consumers have to process the environmental consequences of a bundle of labeled and non-labeled items or that of a sequence of decisions made over time.

One of the primary cognitive biases that underpin these psychological effects of environmental footprint labeling seems to be that people seek an average when they attempt to process complex stimuli that comprise both environmentally friendlier and more environmentally harmful components (Holmgren *et al* 2018a). For example, when asked to estimate the environmental impact of a set of buildings, people accurately assign a lower value to buildings with a low carbon footprint compared to buildings with a higher carbon footprint. However, they also report that the environmental impact of the two sets of buildings combined is lower than the buildings with high carbon footprint alone (figure 2). This averaging bias makes the perceived environmental impact of a set of items decrease when items with low carbon footprint are added to the set, whereas in reality the absolute environmental impact levels increase.

Environmental footprint tools have unquestionable merits. They can indeed steer behavior towards desired outcomes and perhaps help people learn the carbon footprint of individual consumer choices over time (Limnios *et al* 2009). Environmental footprint tools can also pave way for positive behavioral spillover effects (Penz *et al* 2019). If consumers learn that they make pro-environmental choices from footprint tools in one domain; that may increase the probability of them taking further pro-environmental actions in other domains. Yet, the lesson learned in the cases presented here is that psychological biases prevent environmental footprint tools from reaching their full potential. An important endeavor is to identify and develop techniques to debias judgement and decision-making that follows from the negative footprint illusion (figures 1 and 2). Such techniques might involve training people to adopt appropriate heuristics (summation in the case of the negative footprint illusion), or to think differently about their judgements. The negative footprint illusion may result from rapid, subconscious and intuitive thought processes that typically accompany the use of heuristics and are sometimes associated with biases (Evans 2018). Therefore, prompting more deliberate, analytic and conscious thought may render judgements that are more robust against bias. This could

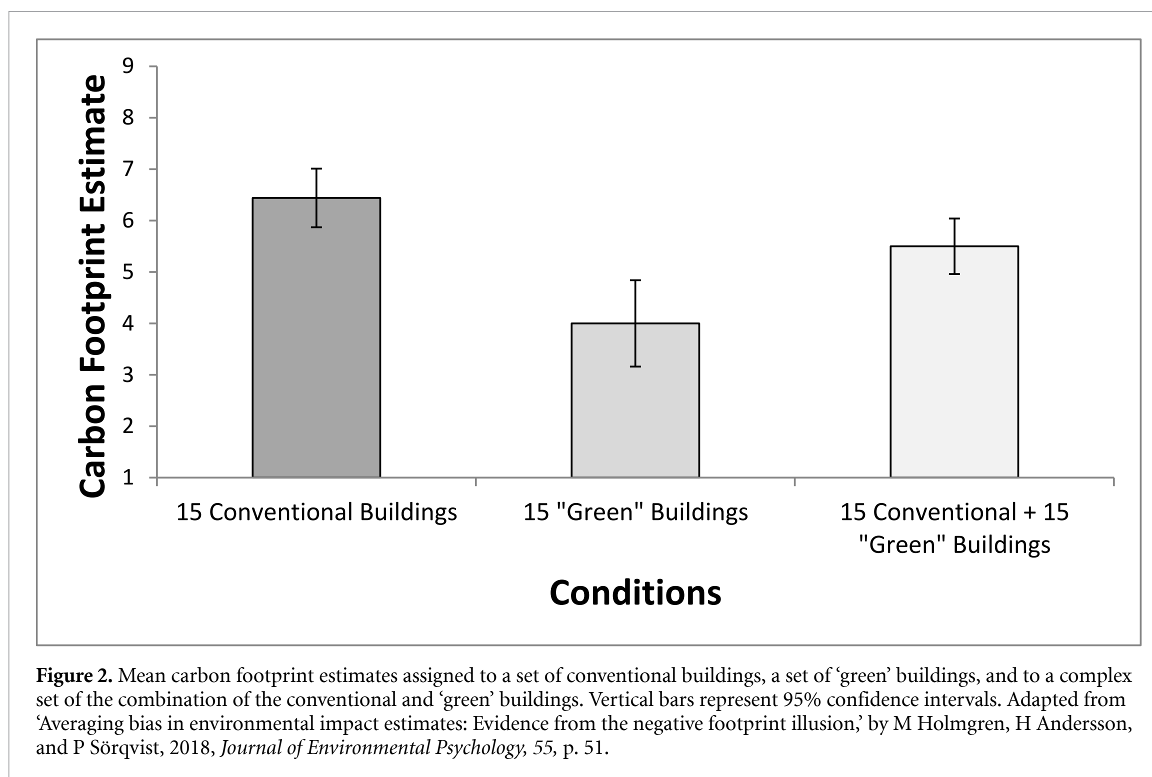

Figure 2. Mean carbon footprint estimates assigned to a set of conventional buildings, a set of 'green' buildings, and to a complex set of the combination of the conventional and 'green' buildings. Vertical bars represent 95% confidence intervals. Adapted from 'Averaging bias in environmental impact estimates: Evidence from the negative footprint illusion,' by M Holmgren, H Andersson, and P Sörqvist, 2018, *Journal of Environmental Psychology, 55,* p. 51.

be achieved by instructing people to generate additional judgements when thinking about their carbon footprints, thereby giving them opportunity to revise their original judgement, or to approach such decisions as if they were required to justify their judgements to somebody else (cf Vieider 2009). Design of labels that better communicate the additive effects of multi-item purchases might also be a way to achieve more deliberate, analytic thought processes among consumers. The bias might be circumvented if individuals are informed that their choice of a product or service always increases their own net carbon footprint and does not in itself have a subtractive effect on the carbon footprint of any other product or service.

However, the tendency to seek a balance between vices and virtues is a fundamental part of human cognition (Sachdeva *et al* 2009). There is a risk that information and communicative labels as an intervention method will not be enough to overcome the tendency for people to average down the net carbon footprint of their behavior rather than attending to the accumulated sum. Environmental footprint tools might have to be complemented with other reforms to overcome this hurdle. A complementary method would be to arrange the physical environment in such a way that people are steered in the direction of pro-environmental behavior even in the absence of deliberate decision making (Kaaronen 2017).

In conclusion, environmental footprint tools might connect consumer choices with environmental consequences accurately. However, evidence suggests that people struggle to accurately evaluate the environmental consequences of bundles of items when informed that these items vary in their carbon footprint. Their assessments tend systematically to be lower than the items' true combined carbon footprint. One target for future research is to find easy and accessible ways to communicate to consumers how carbon footprints add together.

Data availability statement

No new data were created or analysed in this study.

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