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Nudging Green: Behavioral Economics and Environmental Sustainability

Springer

World Sustainability Series

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Due to its scope and nature, sustainable development is a matter which is very interdisciplinary, and draws from knowledge and inputs from the social sciences and environmental sciences on the one hand, but also from physical sciences and arts on the other. As such, there is a perceived need to foster integrative approaches, whereby the combination of inputs from various fields may contribute to a better understanding of what sustainability is, and means to people. But despite the need for and the relevance of integrative approaches towards sustainable development, there is a paucity of literature which address matters related to sustainability in an integrated way.

Notes on the quality assurance and peer review of this publication

Prior to publication, the works published in this book are initially assessed and reviewed by an in-house editor. If suitable for publication, manuscripts are sent for further review, which includes a combined effort by the editorial board and appointed subject experts, who provide independent peer-review. The feedback obtained in this way was communicated to authors, and with manuscripts checked upon return before finally accepted. The peer-reviewed nature of the books in the "World Sustainability Series" means that contributions to them have, over many years, been officially accepted for tenure and promotion purposes.

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Editors

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Preface

Recently, there has been a growing recognition of the imperative to tackle environmental concerns. The environment today is at the crux of breaking down because of the unscrupulous use of natural resources that is having an adverse effect on the environment. Climate change, pollution, deforestation, and biodiversity loss jeopardize the fragile equilibrium of our planet's ecological systems and the welfare of present and future generations. In light of increasing apprehensions, an urgent need is for efficacious approaches to advance environmental sustainability. Behavioral economics uses the concepts and elements of psychology and applies them in economic decision-making. It has been identified that behavioral economics can be used to tackle the issue of climate change by using "nudges" to influence people to make more eco-friendly choices. Behavioral economics also accepts the presence of cognitive biases in the decision-making process, and one solution to reduce the biases is instigating "nudges" that increase the probability of making optimal decisions. The book provides an in-depth understanding of environmental and climatic issues and people psychology's role in addressing them. The book highlights the cognitive biases and nudges that can be used to negate or reduce the negative impact of decision-making on the environment. This book thoroughly examines several facets of pushing green, investigating how behavioral insights might guide the development of environmental policies, company strategies, and individual actions. The chapters in this volume thoroughly analyze the possible uses of behavioral economics in promoting environmental sustainability, encompassing energy saving, waste reduction, sustainable consumption, and mobility. Every chapter of the book provides a comprehensive analysis of case studies, empirical data, and practical techniques designed to utilize nudges to tackle environmental concerns effectively. This book is an excellent resource for governments, entrepreneurs, researchers, and activists promoting a more sustainable future. It achieves this by showcasing successful efforts and defining essential concepts for effective nudging. In light of the intricate and interconnected challenges posed by environmental degradation and climate change, it is imperative to adopt creative methodologies. By incorporating principles derived from behavioral economics into our endeavors to advance environmental sustainability, we may explore novel avenues towards fostering a more robust planet and a more promising

future. We express our gratitude to the individuals who have generously contributed their knowledge and valuable insights to this publication, as well as to the readers who are interested in enhancing their comprehension of the potential of behavioral economics in promoting environmental sustainability.

New Delhi, India

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Green Nudging: A Behavioral Approach to Environmental Policies

Nicolao Bonini and Alessia Dorigoni

Abstract Humanity is facing several environmental challenges such as pollution of the earth, water, and air, scarcity of water resources, and a decline in biodiversity, to name a few. The human factor appears to be a determinant, at least in part, of those environmental threats. How to make people behave in a more environmentally friendly manner is thus an urgent issue. Traditionally, environmental policies rest on the notion of economic rationality (the "Homo Oeconomicus" paradigm), whereby it is assumed that human action is selfishly guided by utility maximization. Accordingly, these policies are based on bans, mandates (e.g., legal norms and associated penalties), incentives (e.g., taxes, prices), and information provisions (e.g., education programs). Since the pioneering work by Herbert Simon on bounded rationality, an alternative paradigm to that of the "Homo Oeconomicus" has been emerged. This theoretical background is the backbone of the so called "behavioral public policies", and specifically those related to the "nudging" approach. In this chapter, we will discuss the behavioral approach to environmental policy, whereby alternative tools to bans, mandates, and economic incentives are used to promote a pro-environmental behavior (PEB). Specifically, four nudges will be described to give the reader a few examples of how the nudge approach can be used to promote a PEB. The psychological mechanism underlying those nudges will be discussed. Additionally, it will be shown how the behavioral approach is quite inexpensive and can be extremely powerful. At the end of the chapter, the general discussion will address current criticisms (e.g., effectiveness and ethical considerations), and open perspectives about the environmental public policies.

Keyword Green nudging · Behavioural public policy · Psychology · Behavioural economics

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1 Introduction

We face numerous environmental challenges such as pollution of the earth, water, and air, scarcity of water resources, and a decline in biodiversity, to name a few. For example, according to a study by the World Economic Forum, Ellen MacArthur Foundation, and McKinsey & Company presented in Davos, Switzerland in (2016), our oceans could have more plastic, by weight, than fish by 2050; there is a growing plastic smog, now estimated to be over 170 trillion plastic particles afloat in the world's oceans (Eriksen et al. 2023).

The human factor appears to be a determinant, at least in part, of those environmental threats. Two decades ago, Nobel Prize winner in Chemistry, Paul Crutzen, and renowned biologist Eugene F. Stoermer (Crutzen and Stoermer 2021) suggested the term 'Anthropocene' to describe our current geological era, characterized primarily by human activities causing significant changes to the planet's landscape, structure, and climate. Individual behaviors, both directly and indirectly, contribute to the environmental threats. As noted by Burger and colleagues (2015), Swiss households consume about a third of the direct energy available, not including that used for transportation. It is believed that domestic consumption habits may account for as much as 60% of global greenhouse gas emissions (Ivanova et al. 2016). A study by Legambiente and Altreconomia (2018) revealed that Italy leads Europe and is second globally in bottled water consumption, averaging 206 L per person per year. According to the report on the bottled water market from The Business Research Company, by value, the bottled water market is going to reach around $350 billion by 2021, following 10% year-on-year growth (Fig. 1).

How can individual behavior be changed to become more environmentally friendly? As defined by Steg et al. (2014), pro-environmental behavior (PEB) is any

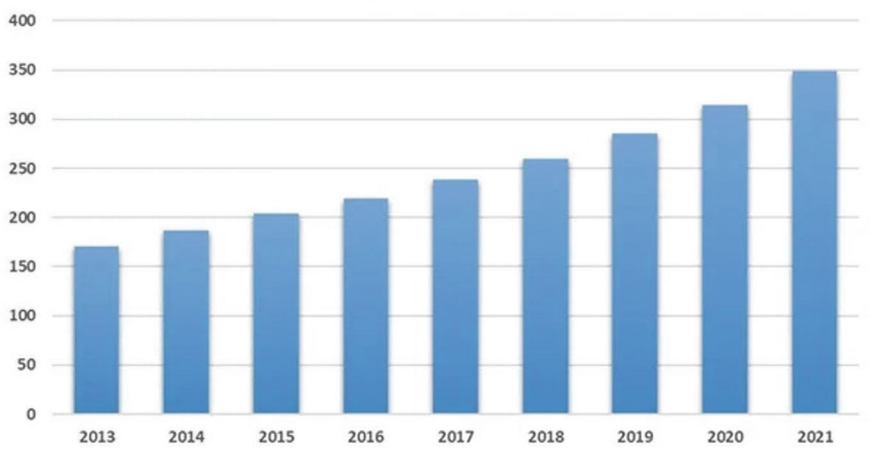

Fig. 1 Global bottled water market, Market Size, 2013- 2021, Value, $ Billion. *Source* The Business Research Company

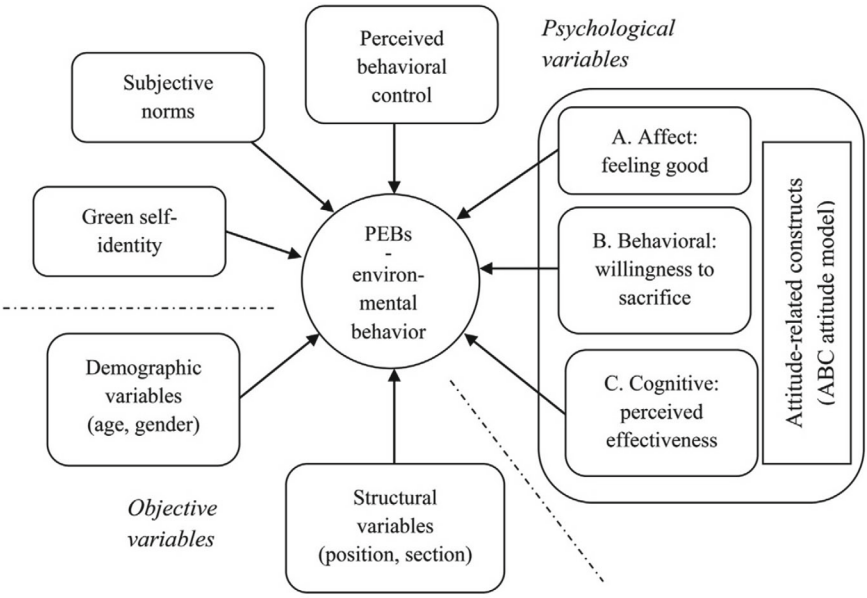

Fig. 2 Predictor variables used for explaining PEBs in the present study. *Source* Hansmann et al. (2020)

behavior that either improves environmental quality or lessens a negative environmental impact. PEB encompasses a broad spectrum of actions ranging from simple daily choices like recycling, conserving natural resources, using public transportation, purchasing eco-friendly products/services to more complex decisions such as advocating for sustainable policies (see Yuriev et al. 2000 for a review). It can be affected by several factors (Fig. 2) such as cultural values (Chwialkowska et al. 2020), environmental attitudes and behavioral intentions (Liu et al. 2020).

Furthermore, individual behavior can negate the potential environmental benefits of green technological developments. Concentrating exclusively on the market's supply aspect may lack foresight and obstruct genuine sustainable progress. Midden et al. (2007) have noted that the energy savings from highly efficient technological solutions can be undone by users' excessive consumption habits. Innovations in products or services from the green market, such as those made with recycled materials, won't have any positive environmental effect if not adopted and used correctly by consumers.

Thus, an enhanced comprehension of the psychological drivers of PEBs, and their facilitating factors is strategic for an environmental policy that aims to promote "green" behaviors. Traditionally, environmental policies rest on the notion of economic rationality (the "Homo Oeconomicus" paradigm), whereby it is assumed that human action is selfishly guided by utility maximization (for a discussion see Amir and Lobel 2008). Accordingly, these policies are based on bans, mandates (e.g.,

legal norms and associated penalties), incentives (e.g., taxes, prices), and information provisions (e.g., education programs).

Since the foundational work by Herbert Simon on bounded rationality (Nobel prize winner in 1978), followed by Kahneman (Nobel prize winner in 2002) and Tversky's studies on heuristics and biases, and those by Thaler on mental accounting and behavioral public policies (Nobel prize winner in 2017), an alternative paradigm has gradually emerged. The depiction of human judgment and decision-making is quite different from that granted by the "Homo Oeconomicus" paradigm. For example, from the two-systems view of human cognition (Kahneman 2003; Stanovich and West 2000), people are prone to errors and biases (e.g., choosing the worst option; behaving inconsistently, or making inaccurate judgments) which are attributed to the features of their intuition, or System 1 (S1) according to Stanovich and West's (2000) terminology.

The functioning of S1 (intuition) is generally rapid, instinctive, seamless, associative, and subconscious (beyond introspective access), frequently with an emotional component. In contrast, S2 (reasoning) works in a methodical, deliberate, and strenuous manner, with a greater likelihood of being subject to conscious scrutiny and intentional regulation. According to the two cognitive-systems model (Kahneman 2003), the dynamics of S1 produce "impressions" that form an intuitive judgment which might be corrected by the S2 reasoning operations (so called "default-interventionist" model). Thus, the fallibility of human judgment would be due to the uncorrected intuitive judgments.

The idea underlying Richard Thaler and Cass Sunstein's proposal of behavioral public policy is to exploit the operations of S1 to attain a behavioral target more likely (e.g., a socially desirable behavior). Their suggestion is deeply rooted in what is known as libertarian paternalism (as discussed by Thaler and Sunstein in 2008 and Sunstein and Thaler 2003a, b). This method suggests that positive behavioral shifts can be realized through subtle policy interventions that gently encourage individuals towards making beneficial choices independently. By leveraging the mechanisms of S1, individuals can be subtly prompted to make certain decisions or take actions through the strategic design of the setting and environment in which the decision-making occurs. Thus, a nudge is "Any aspect of the choice architecture that alters people's behavior in a predictable way without (i) forbidding any options or (ii) significantly changing their economic incentives" (Thaler and Sunstein 2008, p. 6).

Recently, nudging has increasingly been used in policy making. The OECD (2018) reports that more than 200 nudge-units, based on behavioral insights have been formed as of 2018.

In this chapter, we will discuss the behavioral approach to environmental policy, whereby alternative tools to bans, mandates, and economic incentives are used to promote a PEB. Structural market factors that affect the availability, price, and quality of sustainable goods will not be addressed. Specifically, four nudges will be described to give the reader a few examples of how the nudge approach can be used to promote a PEB. The psychological mechanism underlying those nudges will be discussed. Additionally, it will be shown how the behavioral approach is quite inexpensive and can be extremely powerful. At the end of the chapter, the general discussion will

address current criticisms (e.g., effectiveness and ethical considerations), and open perspectives about the environmental public policies.

2 Green Nudges

The literature shows several ways to classify a nudge (for a review see Grilli and Curtis 2021), and provides different interpretations of how a nudge operates to promote a desirable behavior (Viale 2022; De Ridder et al. 2022; Bhargava and Loewenstein 2015; Halpern 2015; Sunstein 2014, 2016; Amir and Lobel 2008; Bonini et al. 2018; Dolan and Metcalf 2015). For example, Amir and Lobel (2008), drawing on the two-systems view of human cognition, propose that an individual can be nudged towards a target behavior either by a "debiasing" or "rebiasing" approach. In the former case (S2-nudge), the choice architecture attempts to correct or eliminate an unconscious human bias. In the latter case (S1-nudge), the choice architecture solution attempts to harness the human bias and use it to nudge individuals toward the desirable behavior. Several authors highlight the significance of S2-type or "educational" nudges that target more deliberate decision-making processes, like revealing pertinent details or providing improved and more transparent information. Likewise, certain nudges, often referred to as "boosts," aim to enhance individuals' ability to make more informed choices independently, such as by advancing their understanding of statistical data (Sunstein 2016; Grüne-Yanoff and Hertwig 2016).

Several nudge strategies as defined by Thaler and Sunstein (2008, p. 6) were used to promote pro-environmental behavior, and they became environmental policy instruments (Carlsson et al. 2021). The cover of "Nudge" by Thaler and Sunstein (Fig. 3) features a depiction of a mother elephant gently nudging her child with her trunk, illustrating the book's central theme of nudging. This imagery represents the subtle guidance or nudges that can be provided to influence decisions and behaviors in a positive direction, mirroring the way the mother elephant guides her offspring, symbolizing the careful and positive influence on decision-making without removing freedom of choice. In the literature by Wee et al. (2021), seven kinds of green nudging methods were identified: prompting, sizing, proximity, presentation, priming, labeling, and functional design. It was observed that most studies on nudging report favorable outcomes in encouraging pro-environmental behaviors. Fostering energy-saving habits stands as a crucial tool in diminishing resource consumption and enhancing energy efficiency.

The systematic literature review by Stankuniene (2021) has shown for example that changes in household energy consumption would allow substantial reductions in energy demand to be achieved.

Here, we do not attempt an exhaustive review of green nudges. We present and discuss the psychological mechanisms underlying a few nudges that are typically considered S1-nudge type. The aim is to give the reader a description of how a nudging-based environmental policy might work and be operated. We focused on S1-nudges because, in the literature, many authors consider them to be more efficient,

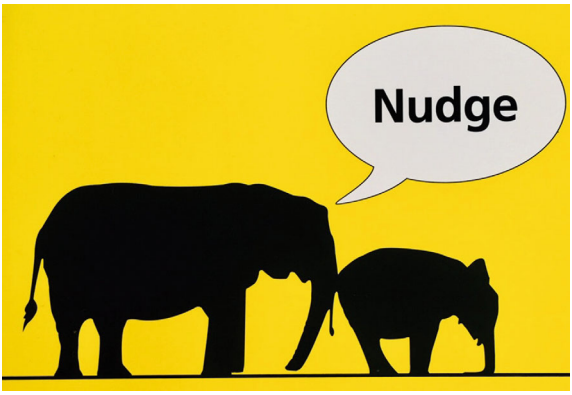

Fig. 3 Thaler and Sunstein's book cover image (2008)

cheaper, and easier to be implemented compared to educational or pricing-based policies (for a discussion, see Benartzi et al. 2017; Allcott and Mullainathan 2010).

2.1 Default Option

A 'default option' is a choice alternative automatically selected in the absence of an explicit preference by the decision-maker. This type of nudge is a classic one and is considered the most powerful (De Ridder et al. 2022). This strategy is frequently used also in commerce, such as online purchases with preselected options. Goldstein et al. (2008) found that seat reservation purchases for train travel increased fivefold when included as a default option with the ticket, compared to when offered separately. This persuasive commercial technique is deemed an unfair commercial practice by the European Union (European Commission 2016).

The impact of default options has been extensively studied in experimental research, both with and without risk (see Jachimowicz et al. 2019 for a review). Typically, individuals tend to select the default option presented to them. This lever is also effective in promoting PEB such as the choice of 'green' electricity rates: when the green tariff is the default option, consumers tend to select it (for more on green defaults, see Ebeling and Lotz 2015; Kaiser et al. 2020; Pichert and Katsikopoulos 2008; and Sunstein and Reisch 2014).

A public intervention using this S1-nudge to reduce paper consumption was implemented by Rutgers University in the United States. Starting July 1, 2008, the office managing computer labs changed all printers from 'single-page' printing as the default to 'double-sided' printing (users wanting single-page prints had to adjust settings accordingly). As reported by Sunstein and Reisch (2014, pp. 133–134), the first four years after implementing the new default resulted in the saving of over 55 million sheets of paper, a 44% reduction, equivalent to about 4,650 trees.

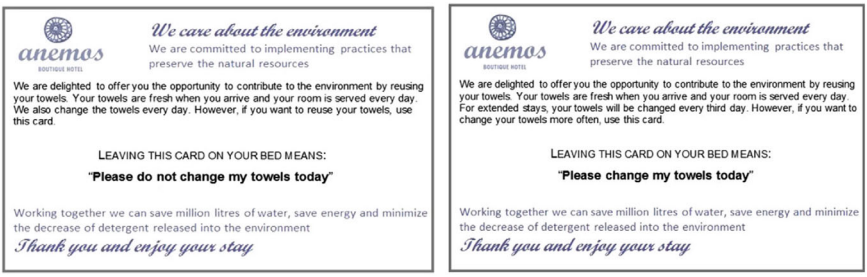

Fig. 4 Opt-in condition on the left and opt-out condition on the right (source: Theotokis and Manganari 2015)

Moreover, this manipulation proves to be more effective than environmental education interventions, which have had negligible results, and even more so than economic disincentives, such as a 10% tax on paper products, which only led to a 2% reduction in paper use. A similar approach in France saw many ministries adopting the same default to save paper as part of the 2009 Exemplary Administration Plan (as referenced in the analysis note by the French Prime Minister's office, March 2011, No. 216, p. 4). Changing the default option stands as a prime example of a nudge intervention: a choice architecture that encourages virtuous behavior through a psychological lever, and minimal implementation costs.

In the study by Theotokis and Manganari (2015), the authors measured participants' intention to participate in a green service under different default policies (opt-in vs. opt-out) regarding towel reuse at a fictitious hotel. Participants were randomly allocated to either the opt-in condition, where towels were replaced daily unless guests chose to reuse them, or the opt-out condition, where towels were replaced every three days for longer stays unless guests requested daily replacement (Fig. 4). The findings indicated that the opt-out default policy is more effective than the opt-in.

He and colleagues (2023), in partnership with Alibaba's food-delivery service, examined comprehensive data at the customer level. Their analysis revealed that implementing green nudges, such as setting the default option to 'no cutlery' and incentivizing consumers with 'green points', resulted in a 648% increase in the proportion of orders opting out of cutlery.

Several studies showed that the green defaults are effective tools in renewable energy program participation (Peterson and Tollefson 2023), reduction of meat consumption (Meier et al. 2022), reduction of carbon emissions (Moin 2022), reduction of street lightning conservation (Meramveliotakis and Manioudis 2023) and many other areas (see Zaho et al. 2022 for a meta-analysis).

2.2 Social Norm

In the animal kingdom, responding promptly and appropriately to the actions of members of its group can be a matter of life or death, such as not following the behavior of a zebra that moves quickly away upon sighting of a predator. Humans are equally influenced by the behavior of others, a phenomenon termed the 'herd effect.' This refers to the collective behavior of individuals acting without centralized direction, which is evident, for example, in stock market trends, public strikes, and cheering in stadiums.

Observing what others are doing is also crucial in promoting PEB. The prevalent behavior in a group establishes what is known as the 'descriptive social norm' (see Legros and Cislaghi 2020 for a social norm literature review). Such norms can be inferred by observation (e.g., if there is no garbage left on a beach, you might infer that people there are correctly putting their rubbish into a trash can). They can also be directly communicated to a person by a statistical information such as "the majority of people agree to donate money to this reforestation project"; "nine out of ten customers at this hotel have reused their towels" or "your electric consumption is 10% higher than the average in your neighborhood".

A groundbreaking study on the role of social norms in encouraging or discouraging a PEB was conducted by social psychologist Robert Cialdini and his colleagues (Cialdini et al. 1990). The authors experimentally manipulated the cleanliness of an environment (playground, parking lot, or beach) by alternating between clean and littered states (e.g., littering or not littering the ground). They then observed how people behaved (e.g., whether they disposed of their trash properly). The research hypothesis was that people would infer the social norm from their environment and act consistently with it. In clean spaces, participants would dispose of their waste properly, while in dirty spaces, they would be more disrespectful towards the environment. The results confirmed this hypothesis.

The findings of Cialdini and colleagues demonstrate that social norms can either promote environmentally beneficial behavior or lead to a boomerang effect, causing harm. Without a moral or ethical qualifier to behavior (such as labeling tax evasion, littering, or not returning a lost wallet as socially unacceptable), people can be influenced in either direction.

Schultz et al. (2007) conducted a field experiment in San Marcos, California, using a combined strategy of explicit social norms and moral qualification through emoticons (injunctive social norms), that effectively promoted PEB, and avoided the boomerang effect. They informed households of their electric consumption in comparison to the neighborhood average. Some households were shown to be above average and others below. In one experimental condition, households received only descriptive social norms (their consumption relative to the average). In a second condition, they also received a moral evaluation of their energy use with emoticons indicating approval for below-average consumption or disapproval for above-average consumption. Results indicated that energy consumption adjusted toward the average when only descriptive norms were provided. However, adding a moral qualification

eliminated the boomerang effect, sustaining the PEB for those who had consumed less energy. For policymakers, the implication is clear: effective messaging must convey not only the individual's behavior in relation to the community but also its moral significance.

An example of a public intervention promoting a PEB through "injunctive" social norms was carried out by the municipal utility in Sacramento, which sent "experimental" energy bills with emoticons to randomly selected users starting in April 2008, as reported by "The New York Times" on January 31, 2009. These bills featured either a smiling or frowning face, indicating the household's energy consumption relative to the average.

The appearance of either a smiling or frowning face on the utility bills was based on how well the user managed to keep consumption below the level of a sample of one hundred similar households in the same area with the same size and heating method. Half a year following the implementation, Alexandra Crawford, representing the city's utility service, shared highly promising outcomes. The analysis revealed that customers who were given personalized reports exhibited a 2% greater reduction in energy consumption compared to those who received generic statements.

Also, she said that this way of reporting energy bills was more effective than traditional economic incentive policies like discounts for purchasing low-consumption appliances. Furthermore, indirect effects were also reported. For example, people started to behave more green-friendly and efficiently in general terms, not just by consuming less energy (e.g., buying a new energy-efficient washer and dryer, putting lights on timers and unplugging their kegerator –a cooler for draft beer). Likely, they were trying to perform better than their neighbours.

These results suggest that economic incentives are not always necessary or sufficient to stimulate a PEB; the incentive must also be psychologically appealing. Additionally, non-economic factors such as the communication of a social norm can be as, if not more, effective than purely economic factors when assessed by a cost–benefit analysis (see Benartzi et al. 2017).

The evocation of a social norm has been used by various researchers in different fields such as recycling, energy, or water saving (see Cialdini 2003). For example, Dorigoni and Bonini (2023) recently showed that putting a poster (Fig. 5) with a descriptive social norm in a restaurant room induced the customers to order tap water (instead of bottled water) four times more often (from 4 to 16%) compared to a control condition.

However, the literature also shows that results are not always consistent. The effectiveness of social norms can be below expectations and dependent on sociocultural contexts. For instance, a pro-social or pro-environmental social norm may be perceived differently and have different behavioral impacts depending on the political attitudes of individuals, liberal versus conservative (see Farrow, Grolleau, and Ibanez 2017; Allcott 2011 for a review).

Fig. 5 Poster with the descriptive social norm used in Dorigoni and Bonini (2023)

2.3 Personal Feedback and Eco-Labels

Nudging PEB can also be achieved by manipulating personal feedback. This nudge relates to how the consequences of one's actions are communicated. A common example of personal feedback is a car's speedometer: the harder we press on the accelerator, the higher the speed displayed. Cognitive psychology has found that the more immediate and salient the feedback, the more effective it is in altering behaviors or aiding learning.

A classic nudge based on immediate and salient personal feedback is the Ambient Orb lamp produced by Southern California Edison. It changes color in response to a household's energy consumption levels—turning red for high consumption and green for optimal usage. The use of this lamp led to a 40% reduction in energy consumption, illustrating the effectiveness of such feedback (Thaler and Sunstein 2008).

Personal feedback can be made even more psychologically engaging. Thaler and Sunstein speculate whether more electricity could be saved if, instead of a simple color change to indicate overconsumption, feedback involved something more personally impactful, like playing one's least favorite song. The potential of digital technology could be further leveraged, for example, by networking individuals with low energy consumption on platforms like Facebook, thus promoting the creation of virtuous social groups that could grow through friendship requests.

Another successful example of using personal feedback to promote a PEB is the "Amphiro" water meter. Installed in showers, it displays real-time water use and employs evocative symbols related to climate change, like a polar bear, to encourage water conservation. The immediacy and saliency of this feedback led to a 20% reduction in shower water use in student residences in Rotterdam and The Hague. Building on this success, The Student Hotel group's water-saving initiative is spreading to countries facing water crises, such as Italy and Spain.

Similarly, another device (like the Ambient Orb lamp) that has proven useful in reducing water use is the "waterpebble". Designed by Paul Priestman, the Waterpebble is calibrated based on the water used during an initial 'virtuous' shower. It changes color from green to red to signal to the user when to end the shower. The melding of creative design and psychological principles can significantly ease the adoption of certain behaviors. Psychology has long established that the likelihood of performing a behavior isn't simply a linear function of an individual's beliefs or values. Other factors come into play. For instance, a person who believes in climate change and considers herself environmentally conscious may still fail to dispose of waste properly if the bin is too far away or has a bad odor. Furthermore, even with high motivation and low effort involved, a person might 'forget' to perform the PEB. Devices like the Ambient Orb lamp, the smart pebble, or the Amphiro meter utilize feedback to remind individuals to act in alignment with their values, such as turning off the shower or lights.

If personal feedback relates to the consequences of our own actions, informational feedback in general communicates the attributes (e.g., environmental attributes) of a decision object, such as the eco-labels on fast (e.g., food and beverages) or slow (e.g., appliances) moving consumer goods.

The aim of using eco-labels is to inform consumers and induce them to choose more eco-friendly goods. However, empirical evidence shows that, for example, the effect of energy labels that were introduced in 1992 by the Council of the European Communities, is quite limited. Waechter et al. (2015) systematically analyzed consumers' reactions to the EU energy label using eye-tracking (ET) methodology.

The labeling captured interest in energy-related information, yet its impact on the product choices of consumers appeared somewhat limited. In their (2020) study, Schmücker and colleagues observed that within a market saturated with sun and beach tourism products, sustainability labels garnered minimal attention. The study found that respondents looked at these labels for only 2% to 3% of the total time they spent focusing on various elements, and for a similar percentage of their total viewing time. The researchers concluded that this modest level of consumer interest in sustainability labels, observed in a realistic setting, corroborates findings from earlier studies. Several factors might account for the relative ineffectiveness of eco-labels, such as previous environmental attitudes of consumers, preexisting preferences, difficulties in elaborating numeric information, scarce psychological salience and/or emotionality of the label, just to mention a few. The literature shows that if the eco-label is easy to understand and emotionally engaging, it might well affect consumer choices. For example, Muller et al. (2019) showed that the use of traffic-light symbols as an eco-label induced consumers to choose low carbon-footprint goods more frequently. Similarly, Vanclay et al. (2011) found that the use of colored carbon-trust symbols (an indication of the carbon footprint associated with the good) was effective in inducing consumers to select more eco-friendly products in a grocery store (Fig. 6).

Eco-labels are closely tied to the practice of identity labeling. The technique of identity labeling serves to deliver a message that resonates with a person's self-concept (referred to as the 'identity label') with the aim of spurring a change in their

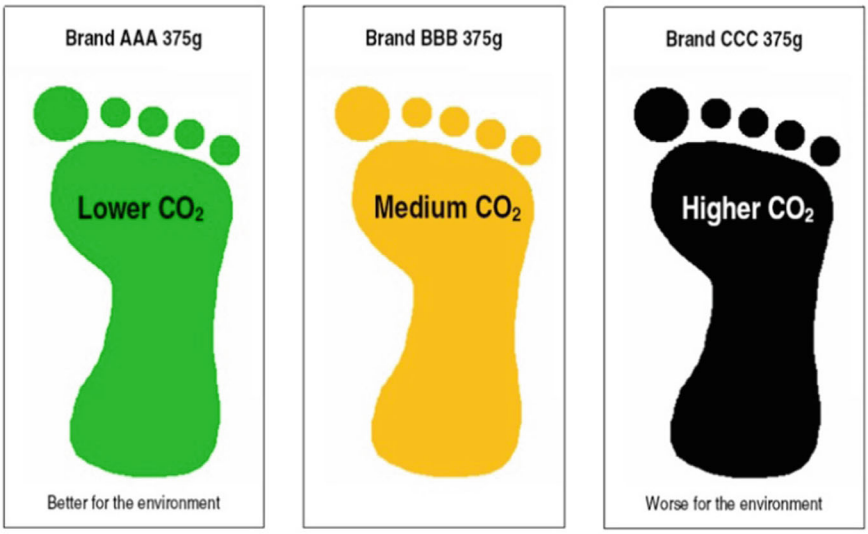

Fig. 6 Labels to indicate carbon footprints of grocery items (*source* Vanclay et al. 2011)

behavior. This method specifically implies that those who are eco-conscious show a preference for products that are environmentally sustainable, signaling to consumers with phrases like 'this product is for green shoppers' or 'I think green' (Schwartz et al. 2020). Such green identity labels appear to hold considerable promise in encouraging the use of eco-friendly products. Based on the principles of self-perception theory, it is understood that individuals deduce their personal values from their actions, and they are motivated by the wish to view themselves in a favorable manner (Venhoeven et al. 2016). Therefore, employing a green identity label has the potential to direct individuals towards decisions that are in harmony with the way they wish to see themselves.

2.4 Emotional Reaction

The motivations behind someone's decision to engage in a PEB are varied and can be economic, moral, or emotional. An individual might properly dispose of their waste because it brings a financial reward, like a shopping voucher or a discount on their waste bill, or to avoid a fine. Alternatively, a person might do so because they believe it's the appropriate course of action, or simply because it's fun. Many local administrations have adopted various versions of 'fun bins'—trash receptacles that provoke pleasant surprises, interest, or positive emotional reactions. These nudges transform the bin into something more engaging, such as a basketball hoop, a deep

well, a representation of a famous singer, or the site of a fun social competition. Examples include the 'vote bin' and the 'basket bin.'

The encouraging results from various interactive waste bins demonstrate that the use of psychological levers can be more effective than punitive measures like fines. For instance, the "deep-well" sound trash bin collected 72 kg of trash in one day, compared to the 31 kg collected by a nearby traditional bin, partly because people enjoyed the unique sound it made upon disposal. Such approaches also counteract the habituation effect, where the novelty of the nudge wears off over time. Furthermore, bins like the "vote bin" tap into social competition and group favoritism, with the possibility of changing the question to maintain interest. For instance, as a segment of its broader MyWandsworth program, the council is rolling out a campaign titled '30 ways to keep Wandsworth clean and tidy' aimed at maintaining the borough's pristine appearance. In this campaign, smokers are encouraged to participate in a poll by discarding their cigarette ends into a slot beneath their chosen option, rather than littering the streets (Fig. 7).

In Crema, Italy, the Young People's Council's experiment over six months gathered over 3,000 cigarette butts using such a bin. Psychological research underscores the importance of affective-emotional reactions in influencing decisions, as seen in the concepts of 'somatic markers' (Damásio 1994) and the 'likeability heuristic' (Slovic et al. 2002), where a positive emotional response to an object or choice can significantly increase the likelihood of engagement.

Fig. 7 Vote bin (*source* Wandsworth.gov.uk)

Affective reactions can be measured in various ways, including subjective rating scales ("How do you feel right now?") or physiological changes, like alterations in skin conductance. The likeability heuristic also seems applicable to PEB. Van der Linden (2018) found that anticipating a positive feeling associated with a PEB could predict whether the behavior would be carried out weeks later, such as lowering a thermostat, running a full dishwasher, or reducing meat consumption. This positive affective reaction to various PEBs explained 30% of the variance in people's 'green' intentions. However, the role of anticipatory affective reaction mainly influences low-cost PEBs rather than high-cost ones. In public policy, leveraging affective reactions can be effective but is particularly suited to encouraging low-cost PEBs.

Psychological research has highlighted the influence of sensorimotor processes on human cognition and action, particularly within the framework of embodied cognition (Wilson 2002).

Emotions significantly influence the decision-making process (Han et al. 2007). In the appraisal-tendency framework, it is observed that viewing brief clips eliciting specific emotions can shape subsequent economic decisions. Lerner et al. (2004) found that willingness to pay for market goods is lower after viewing a disgusting video clip compared to an emotionally neutral one, due to the action tendencies linked to specific emotional reactions. This connection between emotion and decision-making extends to PEBs, where emotions can significantly influence whether a pro-environmental action is taken.

Schwartz and Loewenstein (2017) conducted an insightful study on the role of "Advertising and Progress" communication in promoting a PEB. They discovered that only videos predominantly inducing sadness were effective in encouraging green behaviors, such as real monetary donations to a WWF project combating climate change. The evocation of sadness, regardless of the video clip's content (impoverished children or struggling polar bears), led to greater donations compared to a control condition featuring an emotionally neutral clip (someone explaining the greenhouse effect). The study utilized three videos, all under three minutes: two elicited sadness equally (impoverished children vs. polar bears), while the third was emotionally neutral (scientific explanation of the greenhouse effect). Notably, the videos were perceived as equally credible and important. In summary, the more intense the emotional experience of sadness, the higher the monetary donations (20% more than in the neutral condition).

The limitation of using emotions as a psychological lever is their transient nature; they fade over time. Schwartz and Loewenstein found that the 'sadness' effect on donation decisions was only present when the decision was made immediately after watching the video. The effect disappeared when the decision was delayed by an hour. This explains why videos with strong emotional content have an immediate but short-lived impact on behavior. The authors suggest capitalizing on the immediate response, akin to the proverb "strike while the iron is hot," by asking for donations or commitments to green behaviors right after viewing an emotional film, without delay.

3 Conclusion and General Discussion

Over the past fifty years, cognitive psychology has reshaped our understanding of human thought and action, moving away from the "Homo Oeconomicus" paradigm that once dominated various scientific disciplines and heavily influenced public policies. According to the new perspective, in certain circumstances, human behavior is flawed and contextually influenced (see the concept of constructed preferences in Lichtenstein and Slovic 2006). The behavioral public policy approach moves from this new perspective. It essentially uses psychological insights to promote virtuous behavior.

The behavioral approach, supported by a scientifically recognized theoretical background (Kahneman 2003), has flourished, with numerous 'nudge-units' like the UK's Behavioral Insights Team established since 2010. Various interventions since then have been attempted by public and private organizations to 'nudge' virtuous behaviors such as organ donation, timely tax payments, or sustainable choices.

The primary advantages of a nudge approach are "relative efficiency" and "easiness" (Bhargava and Loewenstein 2015; Mullainathan et al. 2010; Benartzi et al. 2017). The first factor relates to the economic dimension, whereas the second one relates to the psychological dimension. For example, Benartzi et al. (2017) analyzed the cost–benefit ratio of various initiatives aimed at reducing household energy consumption, finding that a dollar invested in a nudge intervention (like that based on the injunctive social norm) yielded a much greater energy saving in kWh than typical economic interventions (like bonuses or discounts), mainly due to the lower implementation costs of the nudge. According to Nobel Laureate Daniel Kahneman, nudge interventions yield «medium-sized gains by nano-sized investments» (quoted in Bhargava and Loewenstein 2015, p. 397, note 3). As for the psychological dimension, as described in the previous section, S1-nudges rely mostly on automaticity of our thinking which is characterized by low cognitive effort.

Despite the increasing popularity of nudging in policymaking, current debates have raised criticisms to this approach (De Ridder et al. 2022; Mills and Whittle 2023; Viale 2022). Below, we summarize the main ones.

First, several authors argue that the effect size of these interventions is quite "small" (for a meta-analysis related to climate change behavioral policy, see Nisa et al. 2019). Other scholars have underlined how scaling randomized controlled trials (RCTs) to the general population might even reduce the magnitude of the intervention's impact. This might be due to several factors, such as the higher homogeneity of the sample used in the RCT, the lack of representativeness of the population in the sample study, "confounding randomness" (e.g., confounded variables are introduced by the sampling procedure) or situational unrepresentativeness when the situation where the sample study is different from that of the large-scale intervention.

Second, scholars have begun to question the "nudgeability" of several interventions. In other words, they question whether a nudge treatment is moderated by several factors (e.g., transparency and awareness of the nudge; preexisting preferences, modus of thinking and socio-economic-status (SES) of the people to whom the

nudge is targeted). A key observation is that individuals cannot be nudged towards actions they are inherently opposed to (De Ridder et al. 2022). For instance, an opt-out default nudge, which automatically allocated a portion of people's tax refunds to a savings account, proved ineffective in cases where individuals had already intended to spend their refunds (Bronchetti et al. 2013).

The call for a better understanding of when a nudge works highlights the issue of lack of theoretical clarity associated with nudge-interventions. A nudge might well work, but it is not clear why. The choice architect often relies on her own intuition or results from surveys/focus groups, which can lead to high opportunity costs if the selected nudge intervention is not actually the most effective, as seen with people's misconception about the effectiveness of smart meters (Nolan et al. 2008; Schultz et al. 2015). This implies arbitrariness or prejudice in the selection of a nudge intervention. A better clarification of the psychological mechanism underlying a nudge might help the decision-maker to select the right one: for example, whether to use an educational rather than a non-educational nudge.

Third, a nudge-inspired policy mostly relies on intrapersonal factors which, in some cases, are strongly influenced by cultural and market aspects. Social norms, both descriptive and injunctive, may be effective in certain communities but not in others. For instance, a pro-social or pro-environmental social norm may be perceived differently and have different behavioral impacts depending on the political attitudes of individuals, liberal versus conservative (see Farrow, Grolleau, and Ibanez (2017); Allcott (2011) for a review). Additionally, market structural characteristics can diminish or negate the effectiveness of a nudge. For instance, a person might possess a strong drive to engage in PEBs, but the availability of green products is scarce, or their cost is prohibitive. Moreover, some nudges are temporary, and their effectiveness wanes over time, such as those based on emotional reactions, as previously discussed.

Lastly, the ethical issue is an umbrella term that comprises different aspects (for a discussion see Steffel et al. 2016; Schmidt and Engelen 2020; De Ridder et al. 2022). The main concern is that the nudge can subtly coerce an individual into making a choice that she would not have made in case of a more deliberative choice. If this is the case, the libertarian side of the libertarian-paternalist approach will be missing because nudges should be, in theory, designed to preserve freedom of choice (Thaler and Sunstein 2008). De Ridder et al., (2022) examined the literature and concluded that nudges (e.g., the default leverage) do not force people to choose what they don't want. In other words, preexisting preferences moderate the nudge effectiveness.

Another ethical aspect that has been addressed in the literature relates to whether people want to be nudged (Reisch and Sunstein 2016; Sunstein 2016; Hagman et al. 2015). Hagman et al. 2015 found that only slightly more than 50% of interviewed people judged the policy based on the default as acceptable, and more than three-quarters of the respondents considered it as an intrusive policy. People prefer more educational nudges than non-educational ones (Sunstein 2016), and this fact should always be kept in mind by the architect of choice.

In sum, which is the best environmental policy? Thanks to the impressive scientific development in the psychological and social sciences, the policymaker now has

a richer toolbox than previously available. Furthermore, these tools are not mutually exclusive. Thus, a design that combines different types of interventions might be the better way to tackle complex environmental threats. For example, the joint use of S1 and S2 types of nudges, an approach that combines a boost (e.g., an education campaign) with an S1 nudge (e.g., emotionally-enhanced graphic warnings or symbols) or a mix between a pricing-strategy and a nudge intervention. For example, Ferraro and Price (2013) found that the combination of prosocial messages (e.g., motives to reduce water use) and social norms (e.g., the comparison of one's own water consumption levels with the neighbor's) was the most effective strategy to induce people to save water than each strategy taken separately.

Also, an environmental policy might try to change the market's structural characteristics via changing personal attitudes such as when nudges increase public support for green economic or socio-political changes.

The issue is complex and, in our judgment, cannot be reduced only to the effectiveness and temporal dimensions of a policy intervention. Other aspects that are related to how a modern and democratic society can be governed should be considered as well (for a discussion of evaluative frameworks, see Mills and Whittle 2022; Viale 2022).

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