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Better regulation and green nudges for more sustainability

Dominik H. Enste / Jennifer Potthoff

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Abstract

Protecting the climate is one of the greatest challenges our society is currently facing. In view of the heated political and social discussions surrounding this topic, the question naturally arises as to whether behavioral-economic insights can be used to sensitize German society to the dangers of climate change and to motivate it towards more sustainability. The field of behavioral economics provides empirical evidence of psychological factors that influence and even hinder sustainable behavior, ultimately leading to a gap between the will to act sustainably and actual behavior. Cognitive barriers, different social factors and group affiliations result in a complex system of diverse behavioral patterns, environmental attitudes, needs and expectations that must be considered when designing environmental policy instruments. People can be motivated to behave more ecologically without restricting their freedom of choice by the intelligent and effective use of green nudges rather than prohibitions. Identifying an effective, target-group-specific and ethical policy for counteracting climate change and encouraging more sustainable behavior requires an interdisciplinary approach combining behavioral-economic empiricism with ethical insights.

1 Introduction: Climate protection

"Capitalism has brought us incredible success. All in all, in today's world we live better and safer, richer and fuller, healthier and longer lives than any previous human generation on this planet" (Habeck, 2021, authors' own translation). According to the World Bank, the share of the world's population living in extreme poverty, i.e. the proportion of those living on per capita incomes below $1.90 (at 2011 PPP) per day, decreased from 42.5 percent in 1981 to 9.2 percent in 2017 (World Bank, 2021a). Between 1950 and 2020 nominal German gross domestic product increased from 49.7 billion euros to 3,332.2 billion euros (Statistisches Bundesamt, 2021a, 2 f.) and the German average life expectancy almost doubled from 1915 (40.5 years) to 2018 (80.89 years) (World Bank, 2021b; Statistisches Bundesamt, 2005). Capitalism has made a huge contribution to today's prosperity, economic growth, and freedom but the continuous drive for progress, growth and improvement also has had its side effects.

According to the World Meteorological Organization (WMO, 2021), 2011–2020 was the warmest decade on record. In May 2021, the Global Monitoring Laboratory (2021) recorded a concentration of carbon dioxide (CO_2) in the atmosphere of 419.55 parts per million. This was the highest level yet recorded and represents an alarming high-water mark for the damage done by humanity to the environment. The concentrations of the other major greenhouse gases methane (CH_4), nitrous oxide (N_2O) and sulfur hexafluoride (SF_6) also continue to increase globally (WMO, 2020, 2) and weather extremes such as heat waves and large storms are becoming more frequent (United States Environmental Protection Agency, 2021). The World Wildlife Fund forecasts that by 2080 up to 50 percent of animal and plant species in areas such as the Amazon and Madagascar may be extinct because of climate change (Price et al., 2018, 10). According to the report of the Intergovernmental Panel on Climate Change (IPCC, 2018, 53) "[t]emperature rise to date has already resulted in profound alterations to human and natural systems, including increases in droughts, floods, and some other types of extreme weather; sea level rise; and biodiversity loss – these changes are causing unprecedented risks to vulnerable persons and populations".

Without doubt, climate change is one of our present society's greatest challenges. In 2021, the German government raised its environmental ambitions by increasing Germany's climate targets. The emission reduction target for 2030 was raised by 10 percentage points to at least 65 percent, for 2040 to at least 88 percent, and climate neutrality is now aimed at by 2045 instead of 2050 (BMU, 2021a, 1 f.). In this way, Germany is trying to make its contribution to the global goal of the Paris Agreement, which is to limit global warming to below 2°C and to pursue efforts to limit it to 1.5°C (European Commission, 2020). According to the calculations of the Federal Statistical Office, in 2019 the annual average carbon dioxide emission per German citizen was 8.5 tons, more than 30 percent higher than the EU per capita average of 6.5 tons (Statistisches Bundesamt, 2021b).

Given these high per capita carbon dioxide emissions, the question naturally arises as to how the population can be motivated to act in a more environmentally friendly way. What are the predominant barriers to ecological behavior? Discussions of this important issue tend to be very emotional and polarizing (Klaiber, 2021), yet it is a topic which concerns the whole of society and thus requires a serious and evidence-based debate without blame or stigmatization. Global strike activities and movements such as "Fridays for Future" have already started raising awareness of climate change. Classical environmental policy measures (e.g. CO_2 certificates) are not broadly accepted by activists and left-wing parties since they increase the price of environmentally damaging products, thus raising the cost of living for the poor. According to the German left-wing party *Die Linke*, some consumers are financially overburdened by the new CO_2 levy. The party therefore demands that companies share the additional financial burden rather than passing it on entirely to the consumer in the form of steep price hikes (Lalee, 2021).

Yet how can people be encouraged to behave in a more ecologically sustainable way without egregious price increases or blanket bans? Is there a way to progress from general prohibitions and mutual finger-pointing towards new, innovative, intelligent environmental policy tools which successfully motivate people to behave more ecologically? How can public policy address public behavior more effectively? One of the main challenges facing German policymakers is to make ecological change as easy as possible for companies and

consumers and to change attitudes and routine behavior permanently. To achieve this, it is essential to effectively address the main factors that influence people's consumption and decision-making. Here, a wide variety of insights gained from the fields of cognitive science, psychology, behavioral economics, and ethics can be used to test and implement new strategies and designs for instruments of environmental policy. A change of perspective is necessary, and an interdisciplinary approach should be the starting point (Deskalakis/ Beckenbach, 2017, 5 f.).

What is the potential role of behavioral economics? How can its insights be used to develop so-called green nudging to a point where it can effectively transform environmental behavior? How can the German government come a step closer to effective and ethical environmental policymaking? What can be done to motivate people to make "greener" decisions? This analysis will respond to these questions, and make suggestions and recommendations as to how behavioral tools can be applied to enhance protection of the climate and the environment. The overall aim of this analysis is thus to predict whether, and to what extent, behavioral economics' more nuanced understanding of human decision-making can improve environmental policies and be instrumentalized for the promotion of greener behavior. It will also be important to reflect critically on the nature of the instruments that suggest themselves and to discuss, for example, whether nudging should be used as a means of implementing ecological consumer policy at all. What about the associated costs and side-effects of such measures? What about such issues as freedom of decision, transparency and the other ethical considerations that have an influence on this debate?

In Chapter 2 we introduce the concept of sustainability. Due to the critical importance and urgency of the specific issue of climate change, this analysis then focuses on climate protection. This is followed by an explanation of how the consumer's decision-making process is considerably influenced by biases and heuristics, a presentation of behavioral economics in public policy, and an introduction to the concept of libertarian paternalism and nudging as its main tool. Chapter 3 elaborates a guideline for the development of behavioral-economic environmental tools. German consumer behaviors and environmental attitudes are analyzed in Chapter 4 at a milieu-level and, on this basis,

milieu-specific recommendations for the use of behavioral environmental measures are given. Finally, a critical discussion of the effectiveness and associated costs of green nudges and the resulting ethical considerations are presented in Chapter 5.

2 The interplay of sustainability, behavior, and public policy

2.1 Sustainability as a concept

The concept of sustainability has its origin in early 18th-century forestry, when the word was first used to describe the principle of not removing more wood than could be replaced by regrowth (Bardt et al., 2012, 4). The term was given new currency by the report published in 1987 by the World Commission on Environment and Development (WCED) entitled "Our Common Future" and commonly referred to as the Brundtland Report. "Sustainable development is development that satisfies the needs of the present without risking that future generations will not be able to satisfy their own needs. […] In essence, sustainable development is a process of change in which the use of resources, the destination of investments, the direction of technological development, and institutional change harmonize to increase the present and future potential to meet human needs and aspirations" (United Nations, 1987). Since the mid-1990s discussion of sustainability has no longer been restricted to scientific circles but has also extended to policymaking and society as a whole. One of the main drivers of this wider interest was the 1992 United Nations World Summit in Rio de Janeiro, where the Agenda 21 was formulated as a global model for sustainable development.

A few years later, in September 2000, government heads from 189 countries adopted the so-called Millennium Declaration (General Assembly Resolution 55/2), which described the tasks and challenges for international policymakers of the 21st century and defined the following interdependent fields of action: peace, security and disarmament, development and poverty reduction, protection of the common environment and human rights, democracy, and good governance (United Nations, 2000, 2 f.). Despite great successes around overall

poverty reduction, the Millennium Development Goals (MDGs) came to be regarded as inadequate, with progress uneven and significant gaps remaining between regions and countries (United Nations, 2015, 8). In 2015, the United Nations therefore set itself a broader system of global objectives by adopting the Agenda 2030 and the 17 Sustainable Development Goals (SDGs), which provide a common language and a compass for all the challenges of the 21st century (United Nations, 2020). In a progress report on Germany's national sustainability strategy the guiding principle is described as follows: "[S]ustainability represents a fundamental challenge, both at the national level and on an international scale. It is our duty and responsibility to respect the limits for the burden on our planet. The task is to find a balance between the requirements of environmental protection, economic productivity, and social responsibility. What we do today must not deprive our children and grandchildren of the opportunity to lead prosperous lives in a sound and healthy environment. For this reason, sustainability is a guiding principle of the Federal Government" (Merkel, 2008, authors' own translation).

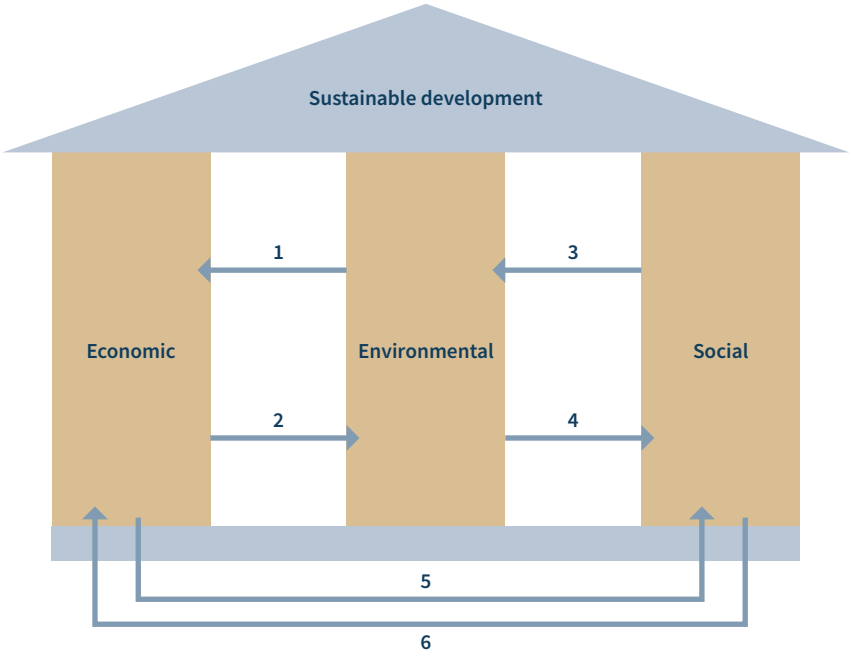
2.1.1 The three dimensions and the SDGs

While awareness and discussion of sustainable development in politics and society have been growing, in recent decades the theoretical concept of sustainability has also been further developed. When debate began, it was largely assumed that unrestrained economic growth inevitably leads to ecological catastrophe. However, this perception has changed over time, leading to consensus that environmental protection can only be achieved if accompanied by economic and social development. It is a view that no longer sees economics and ecology as diametrically opposed but regards sustainable development as a balance between economic, ecological, and social goals. This is the main idea of the three-pillar model of sustainability (Figure 1) established by the 1995 German Commission of Inquiry into "Protection of the People and the Environment".

The model represents the multidimensionality and interdisciplinary character of sustainability, with ecology, economics, and social security forming an inseparable unity in which each is of equal importance and dependent on the other two (Arzberger, 2010, 31; Bartol/Herkommer, 2004, 2). Thus, sustainable development is not seen as a one-sided concept, but rather as a holistic view of the future.

The three pillars of sustainable development

Figure 1



Source: Authors' own diagram based on Stevens, 2005, 1, 5 f.

The **environmental** pillar stands for the preservation of the natural basis of life for our and future generations and calls for the protection of the environment, including all natural resources. Its aims are to avoid damage to the ecosystem, to prevent climate change and to ensure that natural resources are consumed at a sustainable rate. Biodiversity is to be promoted and the effects of climate change, such as a rise in global temperatures and an increase in sea levels, are to be minimized. Further measures include a sparing use of water, energy and raw materials and keeping emissions and other forms of air pollution to a minimum. Of the SDGs referred to in the previous section, numbers 13 "Climate action", 14 "Life below water", and 15 "Life on land" can be assigned to the environmental pillar (United Nations, 2020).

From the economic perspective, pursuing sustainability means designing the global economic system in such a way that future generations will also be able to use and benefit from it. A carefully optimized use of renewable resources and a minimal consumption of finite raw materials are its main requirements. At the corporate level, the goal of economic sustainability means pursuing long-term strategies, ensuring regular operating profits, consistent liquidity and the ongoing viability of the business rather than maximum short-term gain (Stöcker, 2020).

For governments, achieving **economic** sustainability includes keeping public debt as low as possible to avoid burdening future generations and maintaining competition and a functioning market so that the economy can support its social goals. Economic quality objectives should be long-term and oriented towards maintaining the functionality of economic systems (Caspers-Merk et al., 1998, 18 ff.). The economic dimension is reflected in SDGs 7 “Affordable and clean energy”, 8 “Decent work and economic growth”, 9 “Industry, innovation and infrastructure”, and 12 “Responsible consumption and production” (United Nations, 2020).

The third dimension of sustainability is the **social** pillar. This represents the ability of a society to persistently instill in its population a feeling of general well-being. The social aspect of sustainability is primarily concerned with securing basic needs and distributive justice for present and future generations. In concrete terms, it strives for poverty reduction, social investments, justice, and solidarity for and between people. A sustainable state or society should thus be organized in such a way that social tensions are kept in limits and that conflicts can be resolved peacefully and civilly. Within companies, the social component of sustainability mainly concerns behavior towards employees and relationships with customers and other stakeholders. Other social sustainability issues include gender equality, self-determination for women and the combating of corruption. Issues such as exploitation and forced work or child labor are negative factors which the social pillar of sustainability seeks to eliminate (Focke, 2019). The social pillar includes the SDGs 1 “No poverty”, 2 “Zero hunger”, 3 “Good health and well-being”, 4 “Quality education”, 5 “Gender equality”, 6 “Clean water and sanitation”, and 16 “Peace, justice and strong institutions” (United Nations, 2020).

As indicated before, it is important to highlight the interaction and interdependency between the three key dimensions of sustainable development (Figure 1). Whereas ecology provides environmental services to the economy by safeguarding natural resources (1), economic activity, in turn, can affect the environment both positively, such as by making green investments, and negatively, for instance by inefficient use of resources, discharging and emitting pollutants, or creating unrecyclable waste (2). The effects of social variables on the environment arise through demographic change, consumption patterns, environmental education, and information (3), while environmental services affect society by giving access to resources and amenities and by contributing to healthy living and working conditions (4). Lastly, the interconnection between the economic and social dimensions of sustainability results from the economy's influence on society in terms of income levels and employment (5) and the effects of social variables on economic activity in the form of labor, population and household structure, education, and consumption levels (6). A correct balance between economic, social, and ecological goals is indispensable for achieving true sustainability (Stevens, 2005, 1, 5 ff.).

2.1.2 How to measure sustainable performance

As the importance of sustainability for corporations, consumers, shareholders, and governments grows, so the question of how progress is to be measured gains in significance. Without specific indicators and a quantitative framework, sustainable development policies lack a solid foundation on which to advance. Indicators are needed to illustrate the linkages and trade-offs between economic, environmental, and social values, to evaluate the long-term implications of current decisions and behaviors and to strive for progress towards SDGs by making clear the baseline conditions (Stevens, 2005, 5 ff.). The Organisation for Economic Co-operation and Development (OECD) has formulated the following key environmental indicators: CO_2 and greenhouse gas emission intensities; ozone depleting substances; SO_X and NO_X emission intensities; municipal waste generation intensities; waste-water treatment connection rates; intensity of use of water, forest, and fish resources; intensity of energy use; and threatened species (OECD, 2008, 5). In their 2019 study, Hristov and Chirico identify five practical key performance indicators which companies can use to evaluate their ecological sustainability performance: use of renewable energy sources, efficient use of resources, total

emissions of greenhouse gases by weight, waste reduction, and percentage of recycled material used (Hristov/Chirico, 2019, 12). As a basis for an international country comparison, there are additionally several different indices which particularly focus on the measurement of national ecological sustainability performance. One of these is the Environmental Performance Index (EPI) compiled by Yale University, which ranks 180 countries on environmental health and ecosystem vitality. EPI rankings indicate which countries are performing well, and which poorly, in addressing environmental challenges (Wendling et al., 2020, 1 ff.; see section 2.1.3 for further information).

To measure the economic dimension of sustainability at the national level, the OECD recommends four specific economic indicators: volume of net capital stock, multi-factor productivity growth rate, net foreign assets, and current account balance (Stevens, 2005, 3). Bardt (2011, 20 ff.) proposes and discusses a more comprehensive set of indicators: inflation rate, labor productivity, unit labor costs, implicit and explicit government debt, tax ratio, working-age population, quality of public administration, rule of law, start-up dynamics, export performance, innovation capacity, foreign direct investments, and diversity of the financial system. For an evaluation of a company's sustainability level in economic terms the key performance indicators might include: return on investment (ROI) related to sustainable investments, percentage of investments in environmental technology, and percentage of production sites with environmental certification (Hristov/Chirico, 2019, 12).

The OECD core set of sustainable development indicators also provides a suitable basis for measuring the social aspect of sustainability. It offers indicators based on such different factors as human capital – measured, for example, by the proportion of the population with upper secondary/tertiary qualifications; the rate of unemployment and education expenditure; health – measured by indicators such as life expectancy at birth and urban air quality; and education and work status – quantified by education participation rates and the employment-to-population ratio respectively. In addition, the OECD considers income distribution, as indicated by a country's Gini coefficient, and consumption, covered by an indicator for household final consumption expenditure (Stevens, 2005, 3). To measure the social component of sustainability at a corporate level, use can be made of such indicators as stakeholders', customers', and

employees' satisfaction rates (Hristov/Chirico, 2019, 12); spending on training measures; and spending on social engagement in relation to total expenditures. As a result of the current climate crisis there is an urgent need for action specifically directed towards environmental sustainability. This analysis therefore concentrates on the ecological dimension of sustainability, with its main focus on climate protection.

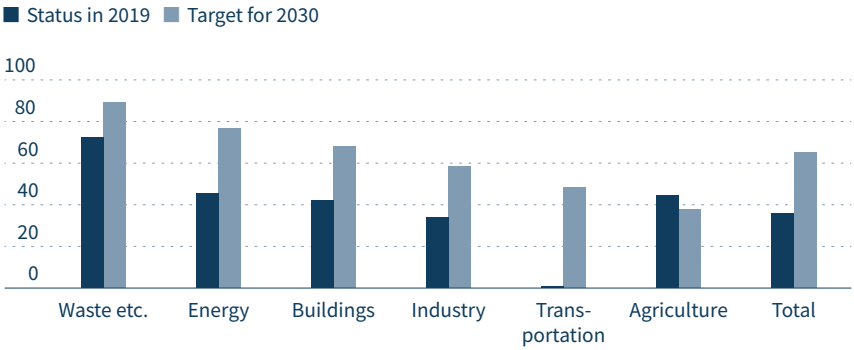
2.1.3 Germany's ecological footprint

Against this background, it is interesting to know where Germany stands in relation to the ecological dimension of sustainability. What is Germany's "ecological footprint"? Between 1990 and 2019 greenhouse gas emissions in Germany decreased from 1,249 million to 810 million metric tons of CO_2 equivalents, a decline of more than 35 percent. However, in response to a ruling by the German Federal Constitutional Court and with a view to the new European climate target 2030, in May 2021 the German government presented a new Climate Protection Act, in which both national and sectoral targets are substantially raised (BMU, 2021a). To stay in line with the European Union's greenhouse gas emission reduction plan, Germany's new target for 2030 is to reduce the total emission level by 65 percent compared to 1990. By 2045, complete greenhouse gas neutrality is to be achieved. Data from Germany's Federal Environmental Agency provides evidence of an urgent need for action to reduce greenhouse gas emissions, especially in the transportation, buildings, energy, and manufacturing sectors (Umweltbundesamt, 2020a). Figure 2 compares Germany's new 2030 sectoral targets for greenhouse gas emission reduction with the actual status in 2019 as a percentage of 1990 levels. The biggest gap exists within the transportation sector with a difference of 47.6 percentage points between the 2019 status and the 2030 target. The second most urgent case is the energy sector, where a shortfall of 31.3 percentage points remains to be made up to meet the 2030 target.

Here, the Yale Environmental Performance Index (EPI) offers a helpful comparison of Germany's environmental sustainability performance with that of other countries. The index is composed of 32 performance indicators across 11 categories weighted as follows: air quality (20 percent), sanitation and drinking water (16 percent), heavy metals (2 percent), waste management (2 percent), biodiversity and habitat (15 percent), ecosystem services (6 per-

Germany's greenhouse gas emission reduction Figure 2

By sector as a percentage of 1990 emission levels



Data: http://dl.iwkoeln.de/index.php/s/Deez4XTsxeHpceo
Sources: Umweltbundesamt, 2020a; BMU, 2021c, 7; authors' own calculations

cent), fisheries (6 percent), climate change (24 percent), pollution emissions (3 percent), agriculture (3 percent), and water resources (3 percent) (Wendling et al., 2020, 2).

Table 1 shows the EPI scores of the top 15 countries in 2020 and their respective 10-year-change values. Given that the EPI compares a total of 180 countries worldwide, Germany's 10th position is relatively satisfactory. However, most of Germany's neighbors have achieved greater environmental sustainability. Germany's index value of 77.2 compares badly with scores of 81.5, 80 and 79.6 achieved by Switzerland, France, and Austria, respectively. The EPI ranks Denmark (82.5) as 2020's most ecological country. It is remarkable that out of the 180 countries surveyed, the top 10 are exclusively European (Yale Center for Environmental Law & Policy, 2020).

Another factor worth examining is how sustainable performance has developed over time, which can be derived from the EPI Index's 10-year change value. With an increase of only 1.2 points, Germany seems to have made little progress within the last decade. It can be assumed that Germany's modest ten-year improvement is partly due to its energy policy reversal in the wake of the nuclear disaster in Fukushima in 2011. The accident at the Japanese nuclear power plant prompted the German government to phase out nuclear energy as quickly

Environmental Performance Indicator – Top 15 Table 1

Country	Rank	EPI score	10-year change
Denmark	1	82.5	7.3
Luxembourg	2	82.3	11.6
Switzerland	3	81.5	8.6
United Kingdom	4	81.3	9.0
France	5	80.0	5.8
Austria	6	79.6	5.4
Finland	7	78.9	6.0
Sweden	8	78.7	5.3
Norway	9	77.7	7.6
Germany	10	77.2	1.2
Netherlands	11	75.3	1.5
Japan	12	75.1	–0.5
Australia	13	74.9	5.5
Spain	14	74.3	8.6
Belgium	15	73.3	2.1

Source: Yale Center for Environmental Law & Policy, 2020

as possible. On June 6 of that year, the German cabinet decided to shut down eight atomic power plants immediately and to gradually phase out all nuclear electricity generation (Bundesregierung, 2021a). As the supply of renewable energy was at that time still limited, the energy shortfall was made up by burning fossil fuels, which emit many more pollutants than nuclear power stations. The amount of coal and lignite involved in net power generation increased from 137.9 and 103.2 terawatt hours respectively in 2011 to 149.2 and 116.7 in 2013, while the amount of nuclear energy produced fell from 102.2 terawatt hours in 2011 to 92.1 terawatt hours in 2013 (AG Energiebilanzen, 2021).

When it comes to the environmental aspect of sustainability, most indicators have so far shown Germany's performance to be relatively unimpressive. However, when making comparisons account should be taken of the fact that Germany is a heavyweight manufacturing and exporting nation. Table 2 therefore shows a selection of the world's mostly heavily industrialized countries together with their EPI score, ranking and score change in the last decade. Of the four, Germany is ranked best by the EPI. With a score of 68.3, the United States comes 24th in the EPI's ranking, 14 positions below Germany. The biggest difference is

Ecological footprint of the world's top manufacturing nations

Table 2

Country	GDP per capita (2019)	Per capita CO_2 emissions (2019)[1)]	EPI rank	EPI score	10-year change
Germany	$46,445.2	8.52	10	77.2	1.2
Japan	$40,246.9	9.09	12	75.1	–0.5
United States	$65,297.5	15.52	24	68.3	2.9
China	$10,261.7	8.12	120	37.3	8.4

1) In metric tons.

Sources: World Bank 2019a; 2019b; Crippa et al., 2020; Yale Center for Environmental Law & Policy, 2020

between Germany and China, which is ranked 120th. Another suitable indicator for comparing the sustainability performances of industrialized countries is the rate of per-capita carbon dioxide emissions (Table 2). According to data provided by the World Bank, in 2019 the German average CO_2 emission was 8.52 metric tons, 45 percent lower than the rate of the United States (15.52 metric tons). At 9.09 metric tons the Japanese rate in the same year was slightly higher than Germany's (World Bank, 2019a). It is noticeable that despite its low EPI index value, China seems to have comparatively small per capita CO_2 emissions. This may be the result of the country's as yet much lower GDP per capita.

As a result of the restrictions introduced during the Coronavirus pandemic, Germany's greenhouse gas emissions fell by 8.7 percent in 2020. Data released by the Federal Environmental Agency shows a decrease in climate-damaging emissions for all economic sectors in 2020. This included a total reduction of around 70 million tons of CO_2 and represented a decrease of 40.8 percent compared to 1990 levels (BMU, 2021b). In addition, Germany has recently made great progress in expanding the production and use of renewable energies. Wind, sun, water, and biomass are now among the most important sources of electricity. At the end of 2020, renewable energy sources' share of total gross electricity consumption was 46 percent. It thus exceeded the government's initial 2020 target of 35 percent (Bundesregierung, 2021b; Federal Ministry for Economic Affairs and Energy, 2019, 6). Ten years earlier, the proportion of renewable energy used in electricity generation was, at 16.9 percent, only slightly more than a third of last year's figure.

The above data shows that though Germany is less ecologically sustainable than other European countries, its relatively moderate environmental sustainability performance compares well with other countries with a large manufacturing sector. Nonetheless, there is a need for urgent action to reach the climate goals Germany has agreed to (Figure 2). While Germany has made huge progress towards its renewable energy targets in recent years, the country has accomplished significantly less in regard to its energy consumption targets. Specifically, the country failed to meet its primary energy consumption reduction target for 2020. Although the German government's energy strategy aimed to cut the nation's primary energy consumption by 20 percent by 2020 compared to the 2008 figure, the actual reduction was 18.7 percent (Umweltbundesamt, 2021). While this is only a slight deviation, the fact that Germany did not succeed in reaching the reduction target despite the short-term energy savings caused by the Coronavirus pandemic in 2020 shows that further efforts must be made within the energy sector. An increase in energy efficiency is essential for reaching climate neutrality but saving energy on a large scale is equally important. Achieving this latter goal, along with more sustainable behavior in general, such as less water consumption, more sustainable transportation choices, less waste and more sustainable diets, will only be possible by changing human behavior. Understanding how people make decisions is thus the starting point for change.

2.2 The consumer's decision-making process

2.2.1 From *homo economicus* to *homo heuristicus*

Neo-classical economic theory assumes that human behavior accords with that of *homo economicus*, an individual that decides entirely rationally and focuses solely on the economic expediency of his or her choice. This perfect, cold-hearted calculating machine maximizes self-interest, is free of emotions and makes mistakes neither in information intake nor in information processing. This suggests that, faced with several offers, consumers always choose the one that brings them the greatest benefit (Beck, 2014, 2).

Research from behavioral economics, however, has shown that human behavior and decision-making are not as rational as this model claims. As Kahneman/

Tversky (1974, 1124 ff.; 2010, 453 ff.) demonstrate, far from being unlimitedly rational, human judgments and decisions are often influenced by heuristics and cognitive biases.

Moreover, with their limited ability to absorb and process information, individuals frequently make mistakes during information intake and processing. Bounded rationality, a concept first introduced by Herbert Simon, references the fact that human cognitive skills are not unlimited. According to Simon (1957, 198), "[t]he capacity of the human mind for formulating and solving complex problems is very small compared with the size of the problems whose solution is required for objectively rational behavior in the real world – or even for a reasonable approximation to such objective rationality". To reduce task complexity in judgment and choices and to prevent an overload of our brain we use mental shortcuts and rules of thumb called heuristics (Beck, 2014, 25 ff.).

Heuristics play an important role in problem-solving and decision-making and are therefore highly relevant for understanding the consumer's decision-making process. On the one hand, heuristics are beneficial in that they help us to make decisions and judgments quickly, without spending a great deal of time on researching and analyzing information. On the other hand, the use of heuristics can also lead to errors and biased judgments (Dale, 2018; Michalkiewicz, 2021). Below, we present the side effects of heuristics most relevant to consumer behavior. In the 1970s, using their own and other scientists' empirical studies, Daniel Kahneman and Amos Tversky identified the following three elementary human probability-assessment heuristics: availability, representativeness and anchoring.

The **availability** heuristic refers to a tendency to overestimate the probability of events that are recent, vivid, or dramatic. Looking for examples to help us take decisions, we tend to recall those that are most readily available in our memory, and to evaluate their outcomes as occurring more frequently. This can lead to false probability estimates (The Decision Lab, 2021a). For example, if we have to guess which is the most dangerous mode of transportation, we might well name flying, because examples of air crashes spring rapidly to mind. This phenomenon has been demonstrated by a number of studies. For instance, in an experiment conducted in 1973, Kahneman and Tversky asked the participants whether they

thought there were more words beginning with the letter K or more which had a K as their third letter. Even though a typical text contains twice as many words in which K is the third letter as those in which it is the first, 70 percent of the participants assumed the opposite. The authors of the experiment surmise that this assessment is due to the fact that a word's first letter is more useful for recalling information than the third, and that therefore examples of the former (kitchen, kangaroo, kale) are more salient and easier to recall than instances of the latter (ask, cake, biking) (Kahneman/Tversky, 1973b, 207 ff.).

The second heuristic documented by Kahneman and Tversky is that of **representativeness**, which describes a tendency to assess the similarity of outcomes, instances, and categories and to use the result as a basis for evaluation. In other words, judgment is made by comparing the present situation to the most representative mental prototype. This can lead to an overestimation of the probability of events that match with our expectations. In a further experiment, the two psychologists gave participants a description of a person called Tom. After being told that Tom was an orderly, detail-oriented, and self-centered man with a strong moral sense, the participants were asked to decide what subject Tom was majoring in at college. The majority of respondents expected Tom to be an engineering major, despite the fact that there was only a small number of engineering students at the college where the study was carried out (Kahneman/Tversky, 1973a, 237 ff.). The two researchers ascribed this surprising finding to the representativeness heuristic. According to Kahneman/Tversky (1972, 431), in situations of uncertainty people "evaluate the probability of an uncertain event, or sample, by the degree to which it is: (i) similar in essential properties to its parent population; and (ii) reflects the salient features of the process by which it is generated".

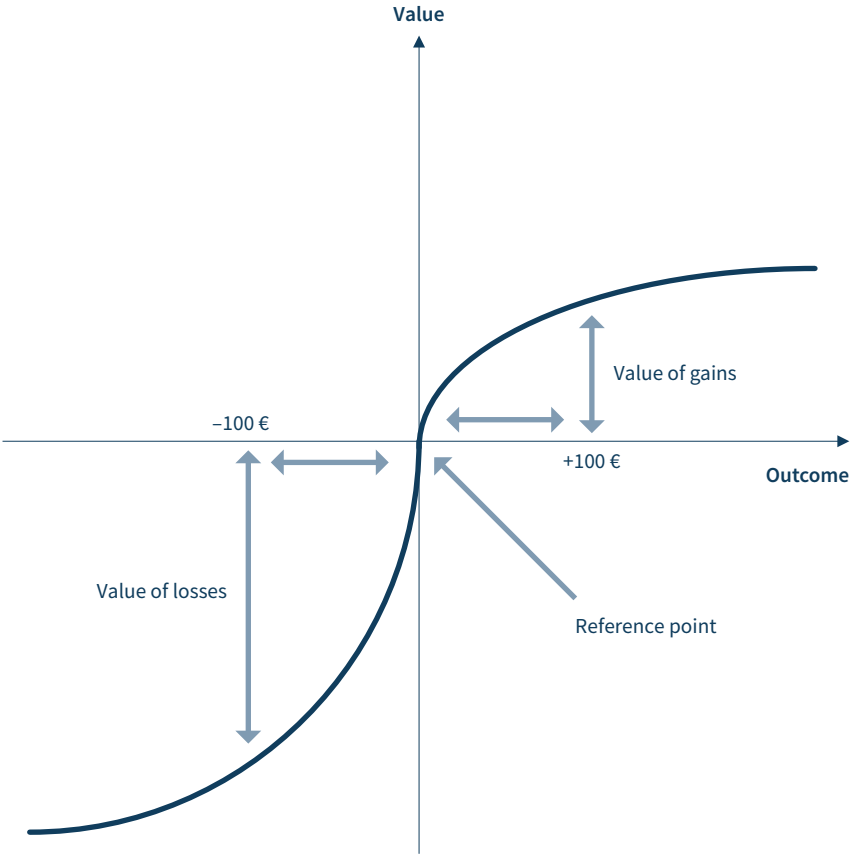
The third major type of heuristic is the **anchoring and adjustment** heuristic, which works on the basis of first impressions. Psychologists have established that people use anchors or reference points as a basis for evaluation. "In many situations, people make estimates by starting from an initial value that is adjusted to yield the final answer. The initial value, or starting point, may be suggested by the formulation of the problem, or it may be the result of a partial computation. In either case, adjustments are typically insufficient. That is, different starting points yield different estimates, which are biased towards

the initial values. We call this phenomenon anchoring" (Kahneman/Tversky, 1974, 1128). The two scientists tested their assumption by asking participants to estimate the percentage of African countries in the United Nations. The result was as follows: If interviewees were given the initial estimate of 10 or 65 as part of the question, the median estimates of the percentage of African countries were 25 and 45, respectively. In both cases, the answers were oriented to the initial value, showing that numbers are particularly effective as anchors for evaluations (Kahneman/Tversky, 1974, 1128). The anchoring and adjustment heuristic affects decision-making in various contexts, such as salary and price negotiations and medical diagnoses. For instance, skillful exploitation of the anchoring effect can increase the amount individuals are willing to pay for a given item (Cherry, 2021).

Such systematic errors resulting from the use of heuristics are ascribed to cognitive bias, the gap between strictly rational behavior and heuristically determined behavior. The work of Kahneman and Tversky and subsequent studies by other scientists have led to the establishment of heuristics and cognitive bias as an important field of research. One major behavioral model developed in this field is the prospect theory (Kahneman/Tversky, 1979), which describes how people choose between alternatives that involve risk and uncertainty and explains the biases involved. Among these is status quo bias, the tendency to prefer the current state of affairs. The status quo is taken as a reference point and any deviation is considered to be either a loss or an unwanted risk. Confronted with a choice, individuals tend to go for the option closest to their status quo, either doing nothing or abiding by a previously made decision. Data from an empirical study conducted by the Leibniz Information Centre for Economics shows that the extent of status quo bias strongly depends on the number of alternatives offered. The greater their number, the more pronounced is the effect of status quo bias. The study established that if there are more than 100 possible alternatives, the level of status quo bias is three times as large as if there are less than 25 (Kempf/Ruenzi, 2005, 16). Moreover, people tend to feel greater regret for poor outcomes resulting from new actions than for the negative consequences of inaction (Kahneman/Tversky, 1982, 160 ff.).

Status quo bias is therefore consistent with loss aversion, a tendency to prefer avoiding losses over a chance to make gains, since pain from loss is almost

The prospect theory value function Figure 3



Source: Kahneman/Tversky, 1979, 200

twice as powerful as pleasure from gain. One of the central conclusions of Kahneman's study of risky choice is that "changes that make things worse (losses) loom larger than improvements or gains" (Kahneman et al., 1991, 199). Figure 3 shows an abrupt flattening of the curve for the positive value of

gains, leading at the 100-euro mark to a 2:1 ratio between the subjective value of the loss and the subjective value of an equivalent gain. This phenomenon leads to generally risk-averse behavior. If there is a sure loss, however, people tend to be more risk-seeking.

Empirical data has also shown that people tend to value an object more if their ownership is clearly established, a tendency known as the endowment effect. Thus people demand a much higher price to give up an object than they would be willing to pay to acquire it. The significant level of pain involved in parting with what is already owned explains what is known as the willing-to-acquire/willing-to-buy (WTA/WTB) gap, the potentially huge discrepancy between buying and selling prices. The phenomenon was demonstrated in 1990 by Kahneman's so-called 'mug experiment'. Forming two different groups, he gave mugs to the first (the sellers) and asked them what price between $0.25 and $9.25 they would demand if they had to sell their mug. The second group (the buyers) were asked what price they would be willing to pay to obtain such a mug. While the median buyer was unwilling to pay more than $2.25 to $2.75, the median owner was unwilling to sell the mug for less than $5.25. The experiment was repeated several times, but the median selling prices were always about twice the median buying prices (Kahneman et al., 1991, 195 f.).

A further decision-making bias related to the prospect theory is the framing effect, the phenomenon by which consumers show inconsistent preferences depending on how a product is described. For example, offered either a disinfectant with the claim that it "Kills 95 percent of all germs" or one which "Only 5 percent of germs survive", most consumers choose the first. The claims are essentially the same, but the formulation, or framing, is different. While the first option highlights the percentage of germs that are killed (a positive attribute), the second option stresses how many germs are not killed (a negative attribute) (The Decision Lab, 2021b). In an experiment which tested the impact of framing effects, risk-averse behavior was induced by a gain frame, risk-seeking behavior by a loss frame. Moreover, an increase in the framing effect was detected when participants were under time pressure (Guo et al., 2017, 541).

Behavior can also be influenced by the actions of others, regardless of the beliefs an individual holds, in what is known as the 'bandwagon effect'. Ex-

perimental studies find evidence of bandwagon behavior in political decision-making. The results of an economic experiment carried out by Ivo Bischoff and Henrik Egbert "clearly show that social information and bandwagon motives shape individuals' decisions to approve or reject policy proposals" (Bischoff/ Egbert, 2010, 15).

Humans seem also to be subject to an optimism bias, a tendency to overestimate the probability of positive events while at the same time underrating the likelihood of negative events occurring. "Evidence from behavioral neuroscience suggests that […] [optimism bias] is underpinned by selective information processing, specifically through a reduced level of neural coding of undesirable information" (Beattie et al., 2017). There is considerable concern about a possible relationship between optimism bias and a lack of due attention to climate change messages. Beattie et al. (2017) analyzed the influence of optimism bias in the processing of climate change messages. Participants were asked to summarize an article about climate change. The experiment found that while a number of test persons concentrated on the dangers of climate change highlighted in the text ("This article is about global warming and how 95 percent of it is due to human activity", Beattie et al., 2017, 21), the majority turned in a more optimistic response, summarizing the article in terms of a debate between two opposing positions ("It's about climate change, about trying to understand what's happening with the weather and there are different points of view", Beattie et al., 2017, 21). The study thus points to an attentional bias towards retaining a state of optimism in the face of climate change messages. Beattie et al. (2017, 34 f.) conclude: "Many people, it seems, have developed cognitive strategies rooted in basic brain functioning that allow them to remain optimistic despite evidence to the contrary. The problem, however, is that some events really do need to be considered with great urgency, and optimism bias can have […] significant negative consequences particularly regarding the discounting of serious risk. Climate change is one such risk."

Optimism bias, then, seems to present a potential barrier to environmental protection. In view of the overwhelming evidence of the emission data presented above (see 2.1.3), it is important to ask what other factors might be hindering sustainable behavior patterns.

2.2.2 Intention-action-gap: barriers to ecological behavior

In a survey conducted by the German Federal Environmental Agency in 2019, 68 percent of a total of 2,000 respondents saw environmental and climate protection as a very important challenge, even more important than two other top issues, education (65 percent) and social justice (63 percent). While this was an increase of 4 percentage points over 2018, one year later, in 2020, the significance of environmental issues had dropped again. Selected by only 65 percent, the topic had been overtaken by problems in education (78 percent) and the health system (73 percent), presumably due to the Coronavirus pandemic. (Umweltbundesamt, 2020b).

However, there has been a significant reduction in the general population's satisfaction with measures taken to protect the climate and the environment. According to another survey by the Federal Environmental Agency, again with 2,000 respondents, the percentage of those who think that the government is doing enough for climate and environmental protection decreased from 34 percent in 2016 to 14 percent in 2018. Where the focus was on local government, the percentage decreased from 49 to 24 over the same period (BMU/UBA, 2019, 16).

Further insights into the German population's environmental attitudes were provided by a representative YouGov survey commissioned by the German energy supply company LichtBlick in 2020, which questioned 2,031 citizens aged 18 years or older. According to the survey, a sustainable lifestyle was "important" or "very important" to three out of four of those surveyed, while almost half responded that climate protection and sustainability were frequent topics among their friends and acquaintances. The results of the survey suggest that many people already choose environmentally-friendly alternatives, with 48 percent claiming to mainly buy regional products, 25 percent to cycle and 26 percent to use public transportation as often as possible for private and professional purposes. 24 percent of those surveyed were willing to make their consumption of food and other products more sustainable in the future (LichtBlick, 2020). According to the European Investment Bank (EIB), which surveyed a total of 30,088 people from 30 different countries, Germans are willing to adjust their lifestyle to fight climate change, with 70 percent claiming to already fly less for holidays and 63 percent asserting that during the winter they heated their homes less to protect the environment (EIB, 2020, 41, 56).

These figures provide evidence of a general awareness of environmental issues and a willingness to act sustainably among the German population. Despite this positive attitude to sustainability, however, 'green' goods are still largely niche products. In 2017, the market share of products with government-approved eco-labels was 8.3 percent and actually declined in 2018 to 7.5 percent, making the government goal for 2030 of 34 percent seem particularly challenging (Statistisches Bundesamt, 2021c, 100). With regard to electric stoves and ovens, the highest efficiency class A+++ had a market share of less than 1 percent and in the food sector organic products also only had a single-digit market share (6.4 percent) in 2020 (Umweltbundesamt, 2020c; Bund Ökologische Lebensmittelwirtschaft, 2021).

The fact that the market share of green products is far smaller than generally expressed preferences might lead us to expect and that Germany's current greenhouse gas emissions are still far from meeting the nation's targets (Figure 2) reveals an inconsistency between attitudes towards sustainable consumption and actual behavior, a phenomenon variously described as the intention-action gap, attitude-behavior gap or mind-behavior gap.

It also points to the existence of barriers which discourage consumers from buying more sustainable products and acting more sustainably in general. If we are to change consumption patterns effectively, it is crucial to understand what these barriers to ecological behavior are. "Agenda 2030 can only be accomplished if we understand the habits and behaviors that prevent our societies from fully achieving sustainable development" (United Nations, 2017).

Why is there such a gap between attitudes to the environment and actual behavior? One possible reason is the optimism bias discussed earlier (see 2.2.1), which distorts the perception and assessment of environmental risks. Moreover, as already pointed out in the same context, consumption decisions are not simple, purposive actions. Rather, consumer choices are subject to situationally limited rationality in which the formation of preferences and consumption behavior depend on social influences (the bandwagon effect) and other anomalies, such as status quo bias, loss aversion, and the endowment effect. These barriers to climate-friendly consumption can be divided into two categories: external and intrinsic.

External barriers include the individual's place of residence and the modes of transportation available there. For instance, someone living in the countryside beyond the reach of regular public transportation will find it more onerous to forego the use of a car than someone who lives in the well-connected infrastructure of a large city. Similarly, the limited availability of organic products in supermarkets and the relatively high price premium they attract in general both constitute external barriers (Terlau/Hirsch, 2015, 7). In a KPMG Consumer Barometer survey conducted in 2020, almost one in four of the 500 respondents (24 percent) were unwilling to pay more for sustainable products and a further quarter (25 percent) balked at a premium of more than 5 percent over conventional products (KPMG, 2020, 14).

Intrinsic barriers can be divided into motivational, cognitive, and behavioral barriers. In the context of climate change, skepticism regarding the impact of one's own personal consumption as a contribution to climate protection can be seen as a **motivational** barrier. The consequence of such a barrier is twofold. The conviction that their own actions do little to save the world from climate change acts as a motivational barrier, discouraging people from engaging in sustainable behavior. Here, the social dilemma posed by collective action or public goods becomes apparent. Described by Alfred E. Kahn as the "tyranny of small decisions" (Kahn, 1966, 23 ff.), and often referred to as the "tragedy of the commons", this conflict between personal gain and collective good arises when "(a) each individual receives a higher payoff for a socially defecting choice (e.g. having additional children, using all the energy available, polluting his or her neighbors) than for a socially cooperative choice, no matter what the other individuals in society do, but (b) all individuals are better off if all cooperate than if all defect" (Dawes, 1980, 169). While the individual can benefit from the short-term overuse of resources, the long-term future costs affect all group members.

The debate about climate crisis and environmental protection is a good example of such a resource dilemma. As pointed out by Enste/Kary (2021), greed can play a significant role when resources are limited. Seen in traditional moral terms, the sins of gluttony, a consequence of affluence, and sloth, resulting in a lack of self-control, can lead to an overuse of resources and thus contribute to the climate crisis (Enste/Kary, 2021, 21 ff., 37, 71).

There are also **cognitive** barriers which negatively influence sustainable choices. For instance, consumers reach cognitive limits and do not always take all product features into consideration, even if objectively informed about them. This can lead to misperceptions of the risk associated with consumption (Haubach et al., 2013, 47). Another potential barrier to environmentally friendly behavior is the phenomenon of cognitive dissonance, the mental conflict that occurs when a person's beliefs do not align. To avoid the resulting feelings of unease and tension, individuals may reject new information that conflicts with their existing beliefs (Leonard, 2019). The need to avoid cognitive dissonance can thus prevent people from absorbing what they hear about climate change and, consequently, from changing environmentally harmful behaviors.

From a **behavioral** economics perspective, there are further explanations for such gaps between will and action. One is that humans are significantly influenced by their social environment (see 2.2.1), with the consequence that consumer habits which are linked to social norms are difficult to change. If the decision to purchase an item, such as an automobile, conforms to social norms and involves the display of social status, emphasizing the environmental benefits of transportation alternatives will do little to change it (United Nations, 2018, 32 f.). Hyperbolic discounting, which leads people to prefer smaller-sooner rewards over larger-later ones, is a further driver of the intention-action gap in environmental terms as it prevents them from persisting with their long-term goals, such as consistently acting sustainably. People generally have a strong focus on the present rather than thinking about the long-term impact of their consumption choices (Markman, 2018).

The intention-action gap is also fed by the tendency to overestimate one's environmental commitment. While most people consider themselves to be sustainable actors, data on emissions and the market shares of green products show that this cannot be the case. Yet in a study by Bergquist (2019, 50 ff.), which asked people how much and how often they performed environmentally friendly activities such as buying eco-labeled products, saving household energy and reducing purchases of plastic bags, most of the participants rated themselves as more environmentally friendly than either other strangers or their friends. The authors conclude that while "most people consider them-

selves to be more honest, more creative, and better drivers than others[, t]his study shows that over-optimism, or the "better-than-average" effect, also applies to environmentally friendly behaviors" (Bergquist, 2019, 50 ff.).

Environmentally-friendly behavior is also discouraged by either a lack or an excess of information. Consumers tend not to be aware of their energy use and its price – and thus their specific impact on the environment – as the real costs of electricity and gas are difficult to ascertain. While detailed information is lacking in certain product categories, in others, such as fast-moving consumer goods, there can be information overload. A surfeit of information increases the complexity of the purchasing process and can lead consumers to avoid a decision and stick with their current situation. Moreover, consumers generally tend to simplify their purchase decisions, for instance by taking into account only the information available at the point of purchase, such as the labels (Haubach et al., 2013, 43 ff.). Ecological certification, such as Germany's Blue Angel and bio-logo, the EU's organic logo and energy label, and the Fairtrade symbol can increase transparency by providing information on the environmental and social impact of consuming the goods they refer to. However, an overload of labels and information in general can be counterproductive. The authors of a United Nations working paper on sustainable industrial development comment: "[T]he proliferation of differing and sometimes overlapping and confusing labelling schemes, in addition to the abundant marketing strategies of firms highlighting their products' environmental attributes, reduce trust and hamper and discourage sustainable consumption" (United Nations 2018, 30). In a study by PricewaterhouseCoopers (PwC), which surveyed 4,000 UK citizens, 20 percent of respondents cited confusion and a lack of trust as the main barrier to sustainable consumption. "The contradictory and sometimes overwhelming information about the implications of buying one product over another leaves consumers confused and unable to act on their concerns at the point of purchase" (PwC, 2008, 6).

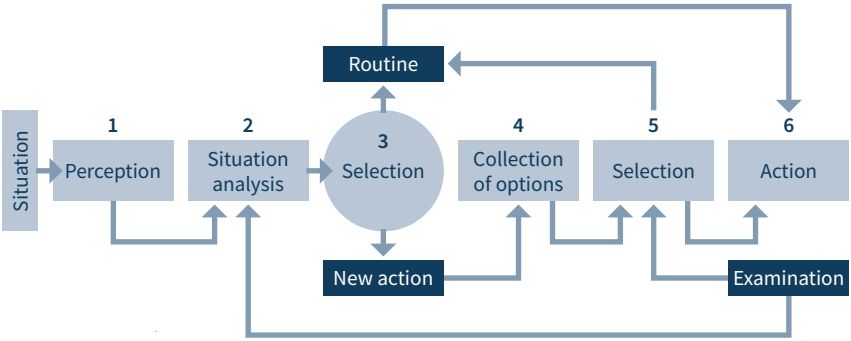
In addition to the barriers to ecological behavior mentioned in this section, weak and unsuitable policies can also hinder the promotion of sustainable development. The relation between policies, ecological behavior and the potential role of behavioral economics will be further discussed in the following sections.

2.3 Environmental policy and behavioral economics

To effectively change consumption behavior for ecological purposes, it is important to understand how consumers take their decisions and how they react to environmental policies. Figure 4 represents the core steps of the decision-making process applied by consumers to ecological issues. These steps need be considered in the design of effective environmental policy instruments.

The model is based on the research of Herbert Simon and it includes six major phases that people go through when dealing with an environmental policy instrument. The decision-making process begins with the perception of the instrument. This first phase (1) is elementary as an environmental policy instrument can only communicate a need for action if people become aware of it. The second stage (2) is the situation analysis, in which the addressees ask themselves what the environmental instrument means and what objective it is trying to achieve. In addition, the target group will assess whether the instrument requires a change in their current behavior patterns. During the next phase, selection (3), a first decision is made on the basis of the situation analysis. If the instrument's aim is to change a course of action, the addressees check whether changes in their behavior are necessary. If they see no need,

The decision-making process Figure 4



Source: Deskalakis/Beckenbach, 2017, 9

their usual routine will be continued and the decision-making process interrupted. If, on the contrary, the instrument is able to motivate them to change their behavior, the decision-making process continues (Deskalakis/Beckenbach, 2017, 10).

In the fourth phase, collection of options (4), the addressees ask themselves how their behavior can be adapted to match the goals of the environmental policy instrument and they search for new courses of action. The fifth phase of the decision-making process is the final selection (5) of an alternative action, and this action is then carried out (6). After this, addressees will tend to check whether the action resulted in the desired success or not. If the action was successful in their view, it may be established as a routine and continually repeated in the future. If not, the decision-making process starts again or repeats previous stages (Deskalakis/Beckenbach, 2017, 9).

To develop recommendations for the implementation of new behavioral environmental policy tools, we must first examine which environmental instruments the German government is currently using. On what basis can the design of new instruments tie in with them and what can be learned from the potential weaknesses of classical environmental policy instruments?

2.3.1 Classical environmental policy

Germany's environmental policy measures are based on international, European, and national climate protection policy. The first of these is mainly guided by the United Nations Framework Convention on Climate Change (UNFCCC), which was launched in 1992 in Rio de Janeiro and has now been ratified by 197 states. The overall aim is to curb manmade climate change and, to this end, annual world climate conferences are held. One of the international climate goals is the 2-degree target of the Paris Agreement.

At the European Union level, several climate protection objectives have been formulated and EU-wide measures designed to combat climate change and to make Europe a climate-neutral continent. Member states must submit integrated national energy and climate plans (NECPs) for the period 2021 to 2030. Further key components of EU climate protection policy are the European Union Emission Trading System (EU ETS) and national emission-reduction

targets determined by the Effort Sharing legislation. Under the former, companies must limit the amount of greenhouse gases they emit in line with the emission allowances they hold (BMU, 2020, 15 ff.). Reduction targets for emissions outside this scheme are divided among the individual EU member states according to their GDP per capita.

At this point, national climate protection policies come into play. In Germany, the 2019 Federal Climate Protection Act provides the legal framework necessary for the country to achieve its national targets and establishes the federal government, the state governments, and municipal administrations as the main actors responsible for detailed environmental policy. The Climate Protection Program 2030 lays down the appropriate measures for all sectors.

The main measures in the energy sector are the end of coal-fired power generation and the expansion of renewable energies. For the transportation sector, the government is planning a CO_2-based reform of the vehicle tax, higher air fares and cheaper train travel. In manufacturing, it foresees investment programs to achieve higher energy efficiency and generate process heat from renewable sources, and a support program for decarbonizing industrial processes. In the buildings sector, key measures include a ban on new oil-fired heating systems from 2026 onwards and a further development of energy standards through regulatory legislation. In the area of agriculture and waste management, the government is focusing on the implementation and enforcement of the Fertilizer Ordinance, an expansion of support programs for organic farming, and an improvement in landfill aeration (BMU, 2020, 17 ff.).

Classical German environmental policy instruments in all sectors can be divided into four types: informational, procedural, economic, and regulatory. While **informational** instruments (information campaigns, environmental education, labels) predominantly aim at raising awareness of climate change, the purpose of **procedural** instruments is to encourage companies to consider the environmental impact of their economic activities during the planning stages. This type of instruments includes interventions such as environmental impact assessments and the EMAS environmental management system, which is designed to help companies to systematically identify and reduce their environmental impact (Thorun et al., 2017, 46).

The third element in the classical environmental policy toolkit is **economic** instruments, such as fees, taxes, licenses, and subsidies, which are the main source of the government's environmental revenues (Adolf, 2008, 326 ff.). Finally, public authorities impose **regulations** requiring individuals and companies to behave in a certain environmentally-friendly way. These mainly take the form of prohibitions, forbidding such behavior as dumping toxic waste in the wild, and requirements, such as compliance with legal limits for environmental pollution (Möckel et al., 2014, 339 ff.). The institutional anchoring of environmental policy at the federal level began with the Waste Disposal Act of 1972 and continued with the central Federal Immission Control Act (1974), the Federal Nature Conservation Act (1976), the Water Resources Act and the Wastewater Discharge Act (1976), the Chemicals Act (1980) and the Federal Soil Protection Act (1998) (Jänicke, 2008). The Water Resources Act (originally adopted in 1957 and substantially revised in 2010) limits the discharge of pollutants into water while the Federal Immission Control Act similarly controls air pollution (Mussel/Pätzold, 2012, 262). Further regulatory tools are the issuance of permits subject to certain conditions and requirements to register, to provide information, or to notify. While there is extensive use of informational and procedural instruments, Germany's classical environmental policy is dominated by bans and restrictions.

Despite certain advantages, such as treating all citizens equally and potentially taking rapid effect, environmental policy measures mainly based on general bans have high costs and deleterious side effects. If the environmental problem they are designed to combat is not understood, generally imposed restrictions can lead to frustration with governmental interference. As market dynamics remain unexploited, there is no real incentive for market participants to go beyond compliance with the law and invest in innovations leading to further environmental progress (Thorun et al., 2017, 49 f.). Nor is an environmental policy mainly based on bans compatible with the economic freedom expected of Germany's social market economy.

The data on consumption and emissions cited above (see 2.1.3) show that the environmental policy instruments currently used need to be accompanied by voluntary changes of behavior if the longer-term climate goals currently under discussion are to be met. Here it should be noted that the classical

environmental instruments essentially address the rational, utility-maximizing human perception ascribed to *homo economicus*. The majority of classical environmental policy tools target the slow, deliberate and conscious part of our thinking referred to by behavioral psychologist Daniel Kahneman as our 'System 2' (Mont et al., 2014, 14).

As a result, relatively high demands are placed on the public's capacity for information intake, which may be one reason why environmental policy instruments have only been partially effective. Given the increasingly complex and pressing environmental problems we face, how can these relatively unsuccessful environmental policy tools be reformulated and redesigned to increase their efficacy and cause less injustice? Changing public consumption habits enough to achieve the climate targets described in Chapter 1 will require addressing consumers appropriately and taking into account their real-life decision-making process (Beckenbach et al., 2016, 23).

As we have seen, consumer choices are subject to situationally bounded rationality, in which the formation of preferences and consumption behavior depends on social influences and a variety of behavioral anomalies such as loss aversion, groupthink, and the optimism and status quo biases. Changing consumption decisions therefore requires more than the exclusive consideration of rational motives. Since the addressees of environmental policy interventions, whether individuals (citizens, consumers, employees) or collective entities (companies, organizations), are always human actors making human decisions, there is a strong need to incorporate insights from behavioral economics into the design of environmental policy interventions. Climate protection policy will only succeed if the real social context of human action is considered. The government's environmental policy toolkit must thus be changed or enlarged if pro-environmental behavior is to be successfully stimulated on a broad scale.

2.3.2 Behavioral insights for public policy

Federal and state ministries strive to achieve politically set goals by developing laws and regulations and trying to implement them in social reality through concrete designs (Fuhrberg, 2019, 77 f.). To do this, in addition to the classical, constitutionally required tools, governments can make use of the

knowledge of behavioral economics. The empirical and theoretical insights of this discipline have become essential for understanding human behavior, and in particular consumer behavior, and they can help to inform and guide policymakers in persuading the populace to make better, smarter, and more sustainable decisions (Reisch/Zhao, 2017, 190 ff.). Behavioral insights help to "[…] ensure that politics reflect actual needs and behaviors for greater impact and effectiveness" (OECD, 2019).

Indeed, the lessons of behavioral research have already been implemented by a number of governments and institutions. The United Kingdom, for instance, established a behavioral task force, and in 2015, following the 2013 coalition treaty which called for a more citizen-centered policy design, Germany set up a behavioral and social science team within the Federal Chancellery's Directorate (Worldbank, 2019c, 73). International institutions such as the OECD, the European Commission and the World Bank are increasingly exploiting behavioral economics, too. The areas of application range from health care, pension policies, and the design of the tax system to sustainability goals (Beckenbach et al., 2016, 42, 46). Behavioral research can help policy makers and public bodies to adjust policy solutions to citizens' real-life behavior and by integrating behavioral insights into policy planning the consequences of policies under consideration can be better anticipated. "By understanding how and under what circumstances BI [behavioral insights] can be applied to cause behavior change, policymakers are far more likely to design and deliver more effective policies" (OECD, 2019, 7).

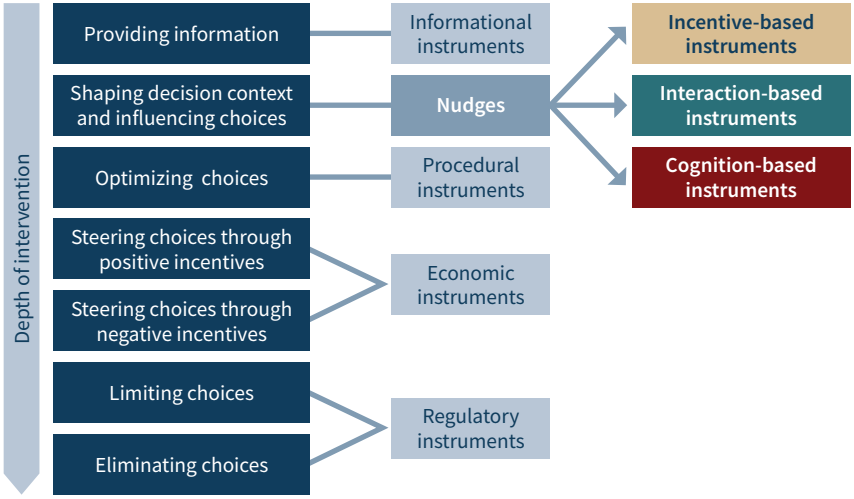
2.3.3 Libertarian paternalism and nudging

As indicated in the previous section, behavioral economics and its practical implications are having an increasing influence on public policy. The idea of using behavioral economics' insights into systematic deficits in rationality to induce people to make better decisions, i.e. ones more conducive to their subjective well-being, without restricting their freedom of choice, is known as libertarian paternalism. That this political philosophy has become popular in science and in policymaking can largely be ascribed to the work of two scientists, Richard H. Thaler and Cass R. Sunstein (Drerup/Dressauer, 2016, 339).

Libertarian paternalism leaves everyone free to decide their own actions as long as third parties are not harmed. As it does not involve the state in direct interventions in individual preferences, this philosophy frees the individual from constraints and obligations to state institutions. Choice alternatives are not excluded but individual decisions are steered in a certain direction. The main tool of this approach, developed by Richard Thaler and Cass Sunstein, is the nudge, described as any measure that "[…] alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives" (Thaler/Sunstein, 2008, 6). The basic idea of nudging is to facilitate complex decisions and to reduce self-control problems by a careful, minimally invasive redesign of decision situations without restricting people's freedom of decision. Nudges work in two possible ways: by taking advantage of human weaknesses such as heuristics and biases, or by counteracting them. Instead of using prohibitions, penalties and taxes, decision architects exploit empirically-proven features of human decision behavior (Fuhrberg, 2019, 82 ff.). Nudges are thus deployed by governments, authorities, institutions and companies to influence people's behavior in a positive way. Whilst admitting that their use by the state is paternalistic, Thaler/Sunstein (2008, 6) insist that it is also libertarian. Figure 5 gives an overview of how the nudge approach is to be classified among the classical instruments of ecological consumer policy.

In contrast to classical environmental policy instruments, nudging is not about commands or prohibitions. Instead, nudges are behavioral instruments that address people's real decision-making behavior and their systemic behavioral tendencies and anomalies. The depth of intervention represented by nudges is thus relatively low compared to classical economic and regulatory instruments, with only informational instruments having a lower level. Nudges do not eliminate or even restrict freedom of choice. Rather, they have a steering function, shaping decision contexts and influencing choices. Indeed, a true nudge will always ensure that it is possible to opt out without prohibitive exit costs (Thorun et al., 2017, 47 f.). Nudges are thus particularly suitable in cases where classical instruments fail. When prohibitions are perceived as too rigid or when economic incentives do not have the desired effect (see 2.3.1), nudging can be an effective alternative way to motivate people towards a certain behavior.

The nudge approach in relation to classical instruments Figure 5



Source: author's own diagram based on Thorun et al., 2017, 49

'Green' nudges are a special form of this tool designed to promote sustainable behavior. Field experiments, studies and pilot tests conducted by such institutions as the OECD, the European Commission, the German Federal Environmental Agency and the World Bank have researched green nudges, providing empirical evidence of their effectiveness. The following chapter provides a guideline for the development of behavioral economic environmental tools.

3 Nudge to action: Behavioral economics for more sustainability

"Achieving sustainable consumption will require great global effort – it is critical that we employ all of the tools at our disposal. By using the deep understanding of decision-making offered by behavioral science, policymakers can design more effective policies to shift consumption patterns and achieve the Sustainable Development Goals (SDGs)" (United Nations Environment Pro-

gramme, 2017, 3). By means of planned communication and goal-oriented decision architecture based on insights from behavioral economics, consumer behavior can be influenced for the benefit of the individual and society as a whole. Individuals can be nudged in a targeted, selective and communicative manner to choose the welfare-enhancing alternative, which in the context of sustainability is the most environmentally-friendly one.

Behavioral insights can be applied to a variety of environmental policy areas such as energy efficiency, water and food consumption, waste management, resource efficiency and transportation choices. This chapter will show how progress in sustainable behavior can be achieved, not with hard instruments such as bans, taxation or sanctions, but rather through effective and 'smart' provision of information, the use of feedback mechanisms, an appeal to social norms, preset standard options and so on. After detailing potential behavior-based environmental policy instruments, we present an analysis of environmental attitudes in different milieus and draw conclusions on these groups' attitudes, behavior patterns, expectations and requirements in terms of sustainability. These findings are used as a basis for recommendations on how nudging can be applied to specific target groups for a more sustainable future.

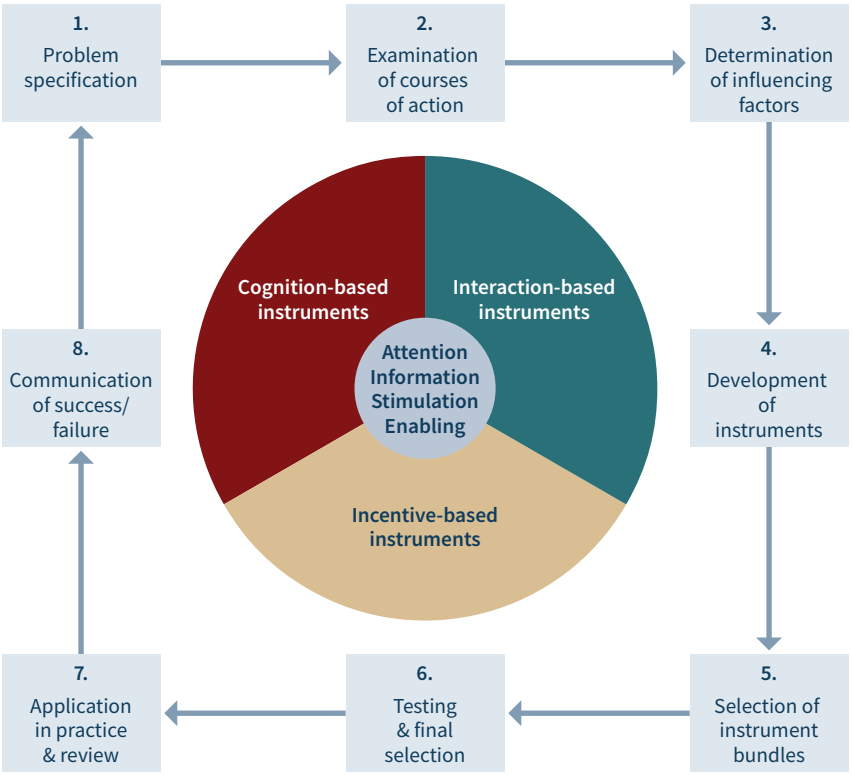
3.1 Core anchors and action phases

Behavior-oriented instruments can help to promote sustainable behavior and to prevent environmental damage, but how are these tools actually implemented? How can, and should, a behavior-based environmental economic toolbox be developed? First of all, four central anchors are essential for the design of behavioral instruments (Figure 6).

As individuals will only engage with an environmental instrument once their attention has been drawn to it, the key to any successful instrument must be the first anchor: **attention**. As previously mentioned, people's cognitive capacities are limited and their attention can be easily distracted; their interest must therefore be not only attracted but also maintained. Secondly, the public will only be willing to take action if sufficiently and appropriately informed; the **information** anchor reminds us of the need to present information graphically, in an easy-to-understand and behavior-based way. The

Core elements of a behavior-based environmental economic toolbox

Figure 6



Sources: authors' own diagram based on Beckenbach et al., 2016, 46; Deskalakis/Beckenbach, 2017, 25

third anchor, **stimulation**, refers to the behavior-based stimuli which prompt the now interested and informed consumers to change their behavior. Lastly, the **enabling** anchor ensures that the behavior-based instrument's desired results are within the target groups' means and capacities. If not, even the best designed measure will fail (Beckenbach et al., 2016, 46).

Besides these four anchors, behavior-based environmental policy tools require relevant action phases. As shown in Figure 6, the development of behavior-

oriented instruments is a process of eight different steps which together ensure that the intervention systematically addresses all relevant factors. First, the problem must be recognized, understood and documented (1). This includes an examination of the behavior-related environmental problems that the measure is intended to solve. Further, the measure's objectives, such as a reduction in water or electricity consumption, and the relevant target groups must be identified. During the second step (2), the way the addressees deal with environmental problems is investigated. Qualitative research methods, such as in-depth interviews and participatory observation, can help to obtain a better insight into their decision-making processes and actions. If there are significant differences between the target groups, these must be considered in the ongoing design of the instruments.

The third step (3) includes a determination of the actions that are to be induced by the measure. It will be necessary to examine how the target groups assess the alternative actions, which influencing factors act as inhibitors, and which motivating factors will contribute to an acceptance of the alternative action. The next step is the development, design, and establishment of the instruments (4) with the ultimate goal of enabling and motivating the addressees to act sustainably. Consideration must be given to the three different types of instruments available: cognition-based, interaction-based and incentive-based. In addition, the development of the instruments should be supported empirically by means of surveys and laboratory experiments. Then, the instruments' presentation and graphic design are finalized. Simple, clear language and good visualization are of particular importance.

The next step (5) is the combination of different instrument types into bundles for joint implementation. The German Federal Environmental Agency recommends always combining a cognitive instrument with a tool of another instrument class (Deskalakis/Beckenbach, 2017, 26). Then, communication costs, possible rebound costs (see 5.1.1), and costs which arise when the interventions cease must be calculated. In addition, a review of behavior-based instruments and a checklist of possible side-effects should be elaborated. The sixth step (6) involves the final testing and selection of the instrument bundles to be deployed. Field studies, field experiments and interviews on behavioral change are recommended testing approaches. The instrument cluster with

the most promising effects in these tests is then chosen. The penultimate step is the practical implementation and review of the instruments (7). Finally, the positive and negative effects of the new behavior-based environmental policy measure must be publicly communicated (8) (Deskalakis/Beckenbach, 2017, 26 f.).

3.2 Behavioral instruments

What kind of green nudges exist and which of them have already been empirically tested and proven successful for the promotion of more ecological behavior? This section introduces the three different types of behavioral instruments, based on cognition, interaction or incentives. Table 3 provides an overview of green nudges classified by environmental field and type of nudge. The examples given in bold type are discussed in more detail later.

3.2.1 Cognition-based tools

Cognition-based behavioral instruments act on processes of perception, information intake, processing and cognitive motivation and they therefore particularly apply to the first stage of a consumer's decision-making process: perception (Figure 4). A common nudging technique in this context is the positioning of the desired behavior as the standard or default setting, which unwilling addressees have to actively deselect if they want to opt out. The setting of defaults is a simple but powerful tool since no effort is required of the decision maker (Schubert, 2016, 17). Defaults capitalize on such cognitive biases as the tendency to prefer inaction over action (inertia) and to stick to the current state of affairs (the status quo bias). Accordingly, this nudging technique has a great impact in decision situations where the addressees are resistant to change.

Besides inertia, there are two further psychological factors that are responsible for the power of defaults, the first of which is loss aversion (see 2.2.1.). Since the default establishes a reference point, which the endowment effect turns into an asset, deselecting it consequently feels like a loss. The combination of the tendency to dislike losses far more than identical gains and the default's ability to indirectly determine what counts as a loss and as a gain increases its efficacy. The second psychological factor behind the power of defaults is their implicit recommendation or endorsement by external authority. Especially in

Examples of green nudges

Table 3

Type of nudge	Energy efficiency	Water conservation	Sustainable mobility	Sustainable food consumption	Waste and resource efficiency
Cognition-based tools					
Changes in the default policy	**Green power as a default**	Bed linen of hotel guests is changed only at the guest's request	Air conditioner does not automatically start with the car engine	**'Take me home' default (May we pack your leftovers for you?)**	**Automatic double-sided printing**
Use of feedback mechanisms	**Smart meters and real-time displays**	**Consumption indicator for the shower**	**Fuel consumption feedback through smartphone app**	Provide information about the ecological footprint of the product	Reference to waste generation/recycling per capita
Changes to the physical environment	Easier turn-off of stand-by appliances when leaving the home	**Placement of stickers encouraging savings next to faucets**	Make sustainable transportation options more prevalent (e.g. more bike-stands than car parking spaces)	**Change of choice architecture for food displays**	Changes in the location and appearance of recycling bins
Framing of information	**Framing energy efficiency attributes (e.g. labels)**	Framing information in water bills	Booking-system nudge	Framing product information and making labels more salient	**Concise slogans or friendly images**
Interaction-based tools					
Use of social norms	**Home energy reports (HERs)**	**Slogans like "The majority of guests reuse their towels"**	Team challenges at work for sustainable mobility behavior	Presentation of best-practice examples	**Feedback about neighbor's recycling rates**
Incentive-based tools					
Reward and penalty schemes	Energy saving accounts	Financial reward if a predefined water reduction target is achieved	Price reduction Tax reduction	Grants for the purchase of sustainable products (points, vouchers)	Announcement of a desired savings value and higher price for excess waste quantities
Simplification			Free trials for public transportation **Carpool nudge**	Offer smaller plates and no trays in university canteens	
Goal setting and commitment devices	**Request to set a direct target (e.g. 10% less electricity)**	Request to set a direct target (e.g. 20% less water)	Defining a fuel savings target	Incentive schemes prompting consumers to opt for packaging-free products	Highlighting the benefits that sustainable practice brings

Sources: authors' own table based on Beckenbach et al., 2016, 61 ff.; Kamm et al., 2015, 25 f., 37 f.; OECD, 2016, 27 f.; Thorun et al., 2017, 57; United Nations Environment Programme, 2020, 13, 15 f.; Greennudging, 2021

the case of complex products, or when people lack expertise or experience, there is a tendency to believe that the default has been chosen for a good reason (Schubert, 2016, 19).

The use of sustainable standard settings has already been tested and implemented in different environmental fields. A practical example is to be found in the energy sector, where the influence of inertia is apparent in the choice of energy contracts. For instance, in what is known as the 'green power default', the eco-tariff often is automatically offered to new registrations or new clients. As the search for alternative contracts or other providers is burdensome, consumers tend to adhere to the default option provided by the energy retailers (OECD, 2017a, 56).

The natural tendency to stick with such defaults has been empirically demonstrated by a laboratory experiment conducted by the Swiss Federal Office of Energy. This tested the type of electricity source mix consumers choose when exposed to different default policies. Participants were allocated to one of the following three treatments: 1) an active choice, which meant actively selecting their preferred mix of green and conventional electricity sources, 2) a green electricity default, which automatically provided renewable electricity but offered the possibility to deselect it or 3) a grey electricity default, where participants automatically received conventional electricity but had the possibility to opt out and choose their own energy mix. Where the premium payable for renewables was low (CHF 0.01 per kWh), the average share of green electricity in contracts reached 86 percent under a green default and 67 percent in the active choice treatment, a difference of 19 percentage points. The finding that green defaults motivate consumers to choose sustainable energy applied when there was a price premium for green electricity of up to CHF 0.03 per kWh. However, when the premium was higher (CHF 0.04 to 0.2 per kWh), the positive effect of the green default declined, as consumers started to opt out of it (Ghesla, 2017; OECD, 2017a, 56, 82 f.).

A further example of the successful exploitation of default settings is that of automatic double-sided printing. According to a medium-scale natural field experiment carried out at 18 departments of a major Swedish university, setting double-sided printing as standard led to a decrease of 15 percent in paper

consumption and this conservation effect was still observable six months after the intervention (Egebark/Ekström, 2013, 1).

In addition to such target areas as energy consumption and resource conservation, changes in default policy can also be used to encourage more sustainable food choices and to prevent food waste. For instance, operators of canteens can make a contribution towards ecologically sustainable nutrition by setting a vegetarian lunch as the default on their daily menus. Moreover, by making it standard practice to take home leftovers, the catering industry can contribute to reducing food waste. In restaurants, for instance, the service staff can imply that taking a doggy bag is socially appropriate by actively asking, "May we pack your leftovers for you?" In the case of canteens, consumers can be invited to take their leftovers with them by placing the appropriate signs in the area where the trays are returned (Kamm et al., 2015, 25, 35, 37).

A further cognition-based nudging technique is the use of feedback mechanisms. Conventional thermostat controls and energy meters are often not designed to be read easily or intuitively, with the result that consumers tend to overlook the information they provide and are thus not sufficiently aware of the level and cost of their energy or water consumption. By contrast, smart thermostats and smart meters connected with in-home displays or smartphone applications provide real-time feedback on energy consumption. Providing consumers with regular feedback makes their behavior more transparent and can increase awareness of the environmental consequences of their routine behaviors and daily consumption choices (OECD, 2017b, 5).

The effectiveness of the smart meter nudge has been empirically proven by an experiment commissioned by the British Office of Gas and Electricity Markets (OFGEM), which tested consumers' responses to the roll-out of smart meters. Multiple trials involving a total of over 61,000 households were conducted by four different energy companies between 2007 and 2011. Among others, the experiment tested such interventions as energy efficiency advice, smart electricity and gas meters, real-time displays (RTDs) that show energy use, and heating and hot water controls with integrated RTDs. Of nine different interventions, the measure most successful in reducing energy consumption was smart meters paired with the installation of real-time information displays.

This combination of devices consistently yielded energy savings of 3 percent. Real-time displays provide live data on energy consumption (kW and cost) and information such as CO_2 emissions and individual energy consumption over specific periods. Some RTDs also have audible alarms or visual signals to warn the customer of excessive consumption (AECOM, 2011, 4). According to the OECD, the positive effect of combining smart meters and real-time displays stems from the fact that "[…] RTDs make energy consumption more salient, frequent, and accurate than meters alone" (OECD, 2016, 19).

Specifically, it has been found that a consumption display for the shower can help to reduce hot water or heating energy consumption through immediate feedback. Empirical evidence is provided by a nudging case study involving environment- and sustainability-smart meters for showers manufactured by the Swiss-based Amphiro Corporation. The Swiss Federal Office of Energy commissioned a controlled trial with 697 households to investigate the impact of behavior-specific real-time feedback on hot water consumption while showering. The Amphiro smart meter shower includes a screen showing the current energy efficiency class (rated from A to G), the temperature, water volume in liters and a polar bear animation to emotionally engage users and make the device appealing to a broad public, including children. By providing normative feedback on the user's water consumption, this nudging technique increases the salience of individual resource use.

The pilot test using the Amphiro smart meter shower showed that, on average, the households in the trial using the smart meter showers decreased both their water use and their energy consumption during hot showers by 23 percent compared to the control group. This result was achieved through pausing the water flow, reducing the water temperature and, especially, shortening the duration of the shower. The treatment exposure resulted in shower duration reductions of 45 to 55 seconds, a decrease of some 18 to 22 percent in relation to the average shower duration in the control group. The savings effects remained constant for the entire two months of the study. The researchers calculated that if this effect persisted and the experiment's result of 23 percent average water and energy savings could be projected over a full year, the average household would generate yearly savings of 443 kWh, 8,500 liters of drinking water, 94 kg of CO_2 and CHF 110 (101.95 euros), making the device

cost-effective within six to nine months. Moreover, the experiment showed that young people are especially receptive to this feedback mechanism. The results revealed a negative correlation of the amount of water use to the user's age, with 20- to 29-year-olds using 72 percent more resources per shower than participants over 65 years. Because of this higher baseline consumption, young people respond more to the feedback, making them a valuable target group for feedback campaigns (Tiefenbeck et al., 2014, 2).

Smartphone applications can also provide feedback on the cost and consumption of transportation fuels. This nudge works by revealing previously unknown information and providing feedback in real time. Such an application collects information on driving behavior and provides immediate feedback on the individual driving style and driving efficiency. In addition, the application provides tips for further improvement of fuel-efficient driving, such as when to shift into a higher gear (Tulusan et al., 2012, 212 ff.).

Thommes/Hoffmann (2019) conducted research on reducing fuel consumption by using feedback mechanisms to change driving behavior. Their research team conducted a field experiment with 104 truck drivers working for a German logistics company. While a control group remained unmonitored, the treatment group received feedback on the fuel-efficiency of their driving style. After an observation period of seven months, the researchers concluded that informing truck drivers about their driving performance can significantly increase their level of fuel efficiency. Compared to their colleagues in the control group, the self-monitoring drivers saved an average of 2.09 euros per week in fuel costs. As CO_2 emissions fall in direct proportion to the drop in fuel consumption, the percentage of the latter gives precise information on the resulting CO_2 emission reduction. In the course of the experiment, average CO_2 emissions were cut significantly: from 837.54 to 792.83 grams of carbon dioxide per kilometer. Moreover, the study found evidence that previous driving performance had an impact on the effectiveness of this nudge. As was to be expected, initially bad drivers improved their performance more than initially good drivers. However, the study showed that the performance of good drivers who were already intrinsically motivated to drive fuel-efficiently before the treatment was not affected by the nudging. Their driving efficiency level remained high during the intervention (Thommes/Hoffmann, 2019).

A further behavioral lever is to be found in changes to the physical environment aimed at providing reminders and increasing attention to the problem. This type of nudge is especially effective in influencing individual decision-making when choices are made spontaneously and based on habits and automated mechanisms. For campaigns promoting waste reduction, such interventions might include changes in the location and appearance of recycling bins, the provision of sorting bins for separating different waste materials or the placement of signs inviting households to keep the neighborhood clean. A potential nudge for water conservation might be placing stickers next to water faucets with slogans such as "Turn off the tap while soaping your hands". To encourage sustainable food consumption, changes in the physical environment might consist in altering the choice architecture for food displays. The effectiveness of this nudging technique was empirically tested by Kurz (2017, 17, 32), who investigated whether meat consumption could be reduced by changing two aspects of a restaurant's physical environment: the order in which the dishes are presented on the menu and the visibility of the vegetarian dish. The results clearly showed that consumers can be nudged towards more climate-friendly diets. After the position of the vegetarian dish on the menu was changed and the dish itself was more conspicuous at the counter, the proportion of non-meat meals selected rose by 6 percentage points, from 14 to 20 percent (Kurz, 2017, 17, 32).

The careful framing of information, a further cognitive instrument, can enhance information intake, prevent information overload, and increase the salience of relevant facts. This type of nudge addresses the individual's limited capacity for absorbing and processing data (see 2.2.1). Formulating energy efficiency attributes, such as those listed on product labels, in clear language and easily understandable symbols reduces the likelihood that they will be left unconsidered at the moment of purchase, thus guiding customers towards more energy-efficient purchases (OECD, 2016, 22).

Empirical evidence of the efficacy of simplification and careful formulation of information is provided by the European Commission, which sponsored an assessment of how various label designs affect consumer understanding and purchase decisions. In the experiment carried out for the Commission, participants were exposed to either standard EU energy labels or simplified,

smaller, and more concise versions. The study found that all the simplified versions led to greater consideration of more energy-efficient products than the standard labels provided to the control group. The best performing label used a frame of reference (A B C D E F G) rather than just a single letter (A) to represent a product's energy efficiency. This type of label led to a purchase rate for the most energy-efficient product of 61 percent, as against 51 percent in the control group. Another finding of the experiment is that labels with alphabetic scales are generally more intuitive and better understood by consumers than labels with numeric designations and therefore lead to more decisions in favor of energy-efficient products (London Economics/Ipsos, 2014).

In addition to this, measures such as a striking and appealing design for the media used for communication (letters, e-mails or posters) with positive, concise slogans, such as "You are a thrifty person", or friendly images, such as a green thumb, can prompt customers to focus their attention on the environmentally relevant properties of the products they are considering, such as service life, energy consumption and pollutant content. Furthermore, clear presentation of the most important facts and a highlighting of monetary values, which are easier to cognitively process than technical ones, can concentrate consumers' attention on the information aimed at them (Beckenbach et al., 2016, 61).

3.2.2 Interaction-based tools

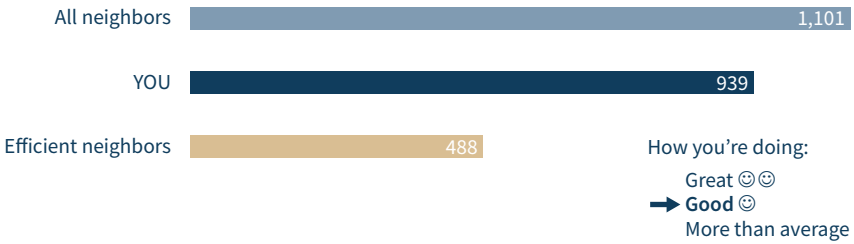
The second type of behavioral instrument we are concerned with here involves interaction and exploits social factors such as herd behavior and the concept of fairness. As argued above (see 2.2.1), people care about their self-image and tend to follow the crowd, making social norms strong influencers of human behavior. Interaction-based tools predominantly impact on choices made during two decision-making phases: situation analysis and selection of possible courses of action (Figure 4). The focus is either on how individuals react to the demands of their social environment or on the interaction between two individuals (Deskalakis/Beckenbach, 2017, 18). Social norm nudges can appeal to either injunctive or descriptive norms. While injunctive norms provide the individual with a moral imperative (what should be done vs. what should not be done), descriptive norms refer to a perception of how most others behave, in other words, the 'normal' way to act.

A good example of a nudging intervention appealing to social norms is an electricity bill which compares the customer's electricity consumption with that of the neighborhood. Various energy providers have started to design detailed energy reports based on behavioral research. These include information about the energy consumption of neighboring households and sometimes also about how the customer's own energy consumption has changed. These and other indirect recommendations to consume less motivate the recipients to save energy. By sending customers home energy reports (HERs) in which their energy use was compared with that of similar neighbors and providing feedback and energy conservation tips, the American utility company Opower achieved average household energy savings of 1.5 to 2.5 percent in the first two years of the campaign. Since 2007, over 17 million American households have received an HER (Center for Behavior and the Environment, 2020; Alcott, 2011, 1082). Figure 7 shows an extract from an Opower HER which compares the customer's current energy usage with that of similar-sized neighboring households and provides consumers with feedback about how they are performing by showing either one, two or no smileys.

In 2015, the World Bank's Governance Practice Group (GGP) and Latin America and Caribbean Unit (LAC) conducted a study to test the efficacy of exploiting social norms to foster water savings. The experiment included a randomized controlled trial of 5,625 households in Bélen, Costa Rica, who received one of three behaviorally-informed treatments. In one of these, households were

Example of a home energy report Figure 7

Last month neighbor comparison



Source: Center for Behavior and the Environment, 2020

made aware of their neighbors' water usage through the simple measure of affixing a brightly-colored sticker with the appropriate information to their water bill. Households whose water consumption was below the mean received a smiley and a congratulatory message, while those with above-average consumption duly received a frowning emoticon. According to the study's authors, the intervention reduced water use by between 3.5 and 5.6 percent of the control group's consumption (Datta et al., 2015, 16).

The power of social norms can be similarly applied to achieving more sustainability in the tourism sector, and can be especially useful in sensitizing customers to environmental issues in the hotel industry. For a study, Goldstein et al. (2008) collected data on 1,058 instances of potential towel reuse in 190 rooms in a midsized and mid-priced hotel over an 80-day span. The guests were not aware that they were participants in the experiment. To stimulate towel reuse, two different messages were printed on signs that were placed on washroom towel racks in the hotel rooms. While the first message was a standard "HELP THE ENVIRONMENT [emphasis in the original]. You can show your respect for nature and help save the environment by reusing your towels during your stay" (Goldstein et al., 2008, 473), the second message appealed to descriptive social norms by suggesting that the majority of the hotel's guests reused their towels: "JOIN YOUR FELLOW GUESTS IN HELPING TO SAVE THE ENVIRONMENT [emphasis in the original]. Almost 75 percent of guests who are asked to participate in our new resource savings program do help by using their towels more than once. You can join your fellow guests in this program to help save the environment by reusing your towels during your stay" (Goldstein et al., 2008, 474). The second message, with its social norm nudge, resulted in a significantly higher towel reuse rate (44.1 percent) than the first (35.1 percent). (Goldstein et al., 2008, 472 ff.).

In a further example, the appeal to social norms was used to encourage waste recycling. John et al. (2013) found that neighbors' recycling rates influence each other and that this effect is intensified in areas with high attachment to the neighborhood, a strong community spirit, and high peer pressure. In their study, residents were provided with feedback about their street's food waste recycling performance in comparison to other streets in the same area. The simple intervention of providing people with feedback about their waste recy-

cling performance and showing either a correspondingly smiling or unhappy emoticon led to an increase in food waste recycling of 3 percent compared to the control group (John et al., 2013, 45).

3.2.3 Incentive-based tools

In addition to cognition- and interaction-based behavioral tools, there are behavioral instruments which motivate their target group to engage in sustainable behavior by using reward and penalty schemes, goal-setting and commitment devices. These incentive-based instruments can be important at the situation analysis stage of the decision-making process (Figure 4), for example by raising the perceived value of a new action over that of an existing one. However, they can also facilitate the development of alternative options, for instance when a financial subsidy is needed to make the development of new actions affordable (Beckenbach et al., 2016, 58). Further, incentive-based tools can offer a financial reward for the achievement of a predefined environmental goal, such as a reduction in electricity or water consumption, or prize money for an environment-related competition. Discounts, subsidies and tax deductions for the purchase of a more sustainable device are further incentive-based measures. Again, points or vouchers can be used to promote sustainable food consumption. On the other hand, incentive tools can also involve penalties, such as demanding a higher price for the disposal of waste quantities above a certain waste-saving target (Beckenbach et al., 2016, 61 f.).

Also an incentive-based instrument, simplification is a nudging technique which encourages sustainable behavior directly by making the sustainable choice easier and more convenient for the consumer. This might involve offering car owners free tickets for public transportation, for example, or easier access to bike-sharing schemes (Thorun et al., 2017, 57). Similarly, companies wanting to limit their workforce's carbon footprint by encouraging carpooling can simplify their employees' decision effort by setting up an internet platform to put them in touch with colleagues who live nearby. The site could include a calendar so that, besides sharing their daily travel to work, staff can also coordinate joint business trips to customers, suppliers, and other branches. Such a behavioral tool was tested by Let's Carpool, an initiative founded to increase vehicle occupancy in the Wellington region of New Zealand. A study

conducted to test their success provides evidence of the effectiveness of this web-based behavioral intervention. The share of commuters enrolled in the scheme who carpooled as their main mode of transportation increased from 12 to 27 percent, while the percentage of those driving alone diminished significantly (Abrahamse/Keall, 2012, 45 f.). Moreover, the convenience of carpooling can be indirectly enhanced by making driving and parking less convenient for lone motorists. Driving solo can be made less attractive by halving the size of parking lots or by providing remote parking for those who drive alone while those who share their cars are allotted spaces next to the front door (Kristal/Whillans, 2019).

Beyond rewards and penalties, incentive nudging techniques include goal-setting and commitment devices. A general tendency to inertia and a corresponding preference for the status quo can be counteracted by setting specific and measurable targets and by using commitment devices (OECD, 2017a, 14). To reinforce motivation, for example, phrases like "I'm in!" can be used as a commitment to sustainable behavior. Moreover, requests to set a detailed action target, such as reducing water or electricity consumption by 10 percent, can increase the motivation to more sustainable behavior (Beckenbach et al., 2016, 59).

The effectiveness of the goal-setting nudge has been empirically demonstrated by a field experiment commissioned by the World Bank which assessed its impact on water consumption. A worksheet with clear information on relative consumption was combined with a request to consumers to write down a personal target for reducing their water use. Tips on how to reach this target were included in the worksheet. According to the study, "[this] plan-making intervention reduced the average of August and September 2014 water consumption by between 0.90 and 1.46 cubic meters per household or about 3.4 percent and 5.5 percent of average monthly consumption for the control group for this two-month period" (Datta et al., 2015, 4). However, the authors note that this nudge had different impacts on different subpopulations. Goal-setting and plan-making appeared to be most effective for low-consumption households who were already motivated to conserve water and just needed support in identifying concrete ways to do so (Datta et al., 2015, 4).

All in all, the studies and field experiments mentioned in this chapter prove that behavioral instruments can induce more sustainable behavior. As empirical evidence has shown, green nudges can be applied to a broad range of environmental goals: energy efficiency and water conservation, more sustainable transportation choices and food consumption, waste reduction and good husbandry of resources. Interestingly, the literature suggests that using a mix of behavioral levers from different categories can maximize the outcome. In one of their working papers, the Federal Environmental Agency analyzed 30 different studies (23 field experiments and 7 practice examples) investigating the effectiveness of behavioral tools in different environmental target areas. The 82 different treatments examined involved cognition-, interaction- and incentive-based behavioral tools. Cognition-based tools were applied in almost all cases (97 percent), a considerable share also used interaction-based instruments (79 percent), while incentive-based tools were involved in less than half (48 percent). Most importantly, however, the majority of empirical studies examined used an instrument bundle, suggesting the advisability of mixing treatments from different categories (Beckenbach et al., 2016, 26).

Moreover, the Federal Environmental Agency's analysis clearly indicates that the effectiveness of the instruments depends on the target group. The latter can be defined by their socio-demographic characteristics, cultural differences, affiliation to certain milieus and whether those addressed are individuals, households or companies (Beckenbach et al., 2016, 242). As we have repeatedly seen in the studies mentioned above, whether concerned with feedback mechanisms or goal-setting, water consumption or fuel-saving, the effectiveness of a nudge can vary significantly, depending on the groups targeted. The success or failure of the behavioral lever depends on the different addressees' potential for improvement in the environmental area concerned, their conscious or subconscious receptivity to the nudge, and their willingness to change their behavior. The heterogeneity of target groups suggests that research on behavioral environmental policy tools should not be generalized but aimed at specific target groups in order to detect possible differences in environmental attitudes and behaviors and therefore responses. On the basis of this research, behavioral environmental instruments can then be designed as precisely and effectively as possible for the groups they are aimed at (see Chapter 4).

4 Social milieus and milieu-adjusted green nudges

Given that behavioral interventions have varying impacts on different groups, developing and communicating effective environmental policies will necessitate subdividing the population into smaller units and identifying the full range of their environmental attitudes, behavior patterns, requirements, and expectations. With this in mind, the present chapter reviews a social milieu model that facilitates the definition and description of target groups for communication on ecological change, analyzes the German population's environmental attitudes and behaviors on the basis of these milieus, and provides guidelines for an effective and precisely targeted use of behavioral environmental tools.

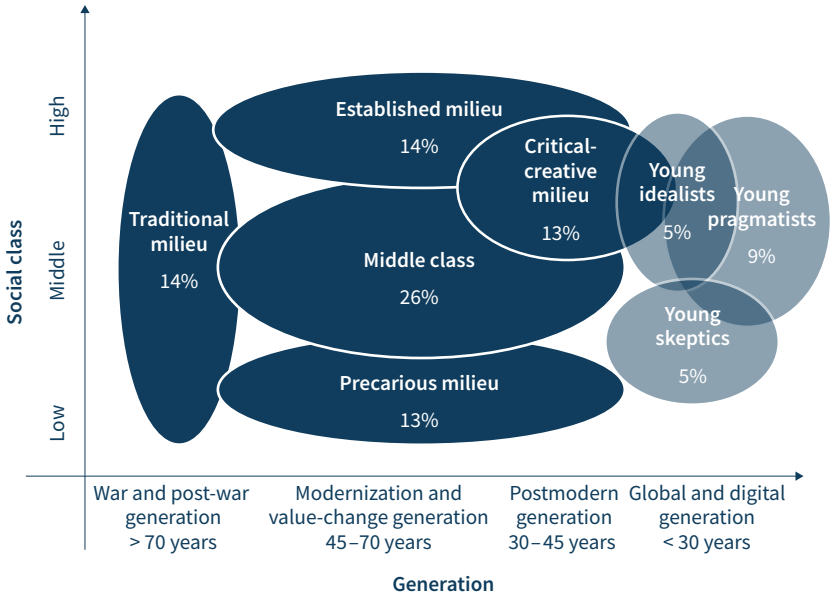
Social milieus describe groups of people who are similar in terms of their attitude to life, their values, mentality, and lifestyle. The classification of milieus in this analysis is based on the model of Sociodimensions (Schipperges, 2019, 2 ff.). This takes account not only of fundamental attitudes and value orientations but also the social situation of different social classes and the sociohistorical experiences of different generations. The original model consists of the eight different milieus depicted in Figure 8. For this analysis, we concentrate on the five social milieus which in 2018 represented more than 80 percent of the German population: the traditional milieu (14 percent), the established milieu (14 percent), the middle class (26 percent), the precarious milieu (13 percent) and the critical-creative milieu (13 percent). The three younger milieus have been excluded, as they constitute only a small fraction of the populace. However, since their environmental behavior is particularly conspicuous with regard to air travel, they are added to the analysis in section 4.6. The milieus are positioned according to their social class (vertical) and their generation (horizontal). The model accepts the impossibility of assigning every individual to a single group and Figure 8 correspondingly includes some areas of overlap (BMU/UBA, 2019, 14).

If we are to compare the different milieus' environmental awareness, attitude to sustainability, and actual behavior, these terms and how they are measured must first be defined. The first official definition of the German term

Classification of social milieus

Figure 8

In Germany, 2018



The figures given for the proportion of the population in each milieu are based on a representative survey of 4,038 respondents carried out in 2018.
Source: BMU/UBA, 2019, 14; authors' own translation

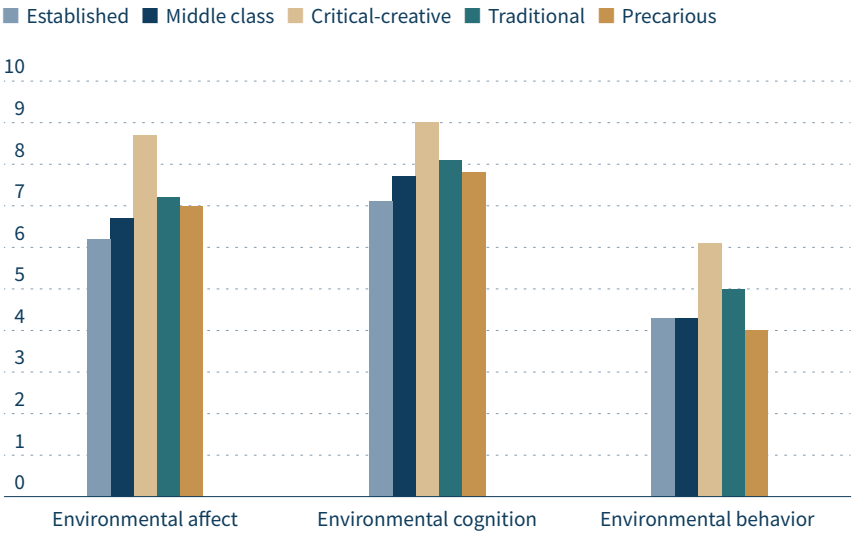
Umweltbewusstsein ('environmental awareness') was included in a report by the German Advisory Council on the Environment in 1978, where it was equated with "insight into the threat to the natural foundations of human life by humans themselves, combined with the willingness to take remedial action" (Deutscher Bundestag, 1978, 440; authors' own translation). In the following analysis, environmental awareness is not treated as one dimensional but measured as the product of three different parameters: environmental affect, environmental cognition, and environmental behavior. Figure 9 depicts the differences between the milieus in terms of these three parameters, based on the results of a representative survey of 2,017 respondents conducted by the Federal Environmental Agency in 2018, in which each aspect was surveyed by a set of seven to eight attitude statements or behavioral self-reports (BMU/UBA, 2019, 67). In addition to a general insight into the influence of different

attitudes on behavior, this survey provides a broad basis for further analysis and, as a snapshot of the situation before the Coronavirus pandemic and the Fridays For Future movement, can function as a control if a new representative study will be published.

The environmental-affect parameter is measured by respondents' level of consent to statements focusing on emotional reactions to environmental issues. Such statements include "It worries me to think about the environmental conditions in which future generations will probably have to live", "It makes me angry when I see that Germany is failing to meet its climate protection targets", and "I get angry when others try to tell me that I should live in an environmentally conscious way". The second parameter, environmental cognition, examines attitudes to statements in which environmental issues are assessed in relation to resource use or to responsibility for the environmental situation of future generations. Positions in terms of this parameter are measured by the

Environmental awareness in the social milieus Figure 9

Parameters of environmental awareness based on mean values of the standardized scale (0 = min; 10 = max), 2018



Data: http://dl.iwkoeln.de/index.php/s/LKZLaRX3ESiBY4Z
Source: authors' own chart based on BMU/UBA, 2019, 72

degree of consent to statements such as “We should not consume more raw materials than can be regrown”, “For the sake of the environment, we should all be willing to cut back on our current standard of living”, or “We need more economic growth in the future, even if it burdens the environment”. The last parameter, environmental behavior, is measured by respondents’ statements regarding their own behavior in different environmentally relevant areas of life such as nutrition, energy use, mobility, and their self-reported commitment to environmental and climate protection (BMU/UBA, 2019, 68). To express these findings as compact indicators, the answers to the questions for each parameter were condensed into total mean values ranging from 0 to 10, with 0 as the minimum and 10 the maximum value of environmental awareness (BMU/UBA, 2019, 72).

Figure 9 shows that, overall, there are strong similarities between the affective and cognitive parameters but fewer between these and the behavioral indicator. While the affective and cognitive statements generally received high approval rates among the five milieus, with mean values of 7.2 and 7.9, respectively, with a value of only 4.7 environmental behavior is clearly less common, providing further evidence of the intention-action gap described above (see 2.2.2). On the basis of this analysis, the following sections examine the different milieus’ varying attitudes to, and expectations of, environmental policy communication. Additionally, milieu-specific differences in the key consumption areas of energy, nutrition, and mobility are identified.

4.1 The established milieu: incentives, default settings, and smart meters

The established milieu predominantly consists of individuals aged from 40 to 70 years with an intermediate to high level of formal education and high to very high household incomes. The monthly net income of the majority (83.6 percent) of households in this milieu is between 3,000 and 6,000 euros (BMU/UBA, 2020; authors’ own calculations). Monthly net household income is the sum of wages and salaries, income from self-employment and pensions, in each case after deduction of taxes and social security contributions. Income from social assistance benefits, renting and leasing, housing allowances, child benefit and other income sources are added to this sum.

Men are slightly overrepresented in this milieu. Its members are extremely performance- and success-oriented, with professional achievement and a high standard of living as important goals. They prize economic efficiency and competitiveness, support economic globalization and are convinced that free markets, as unregulated as possible, are the best way to promote development (BMU/UBA, 2019, 15, 76).

In line with these characteristics, the established milieu has a more rational attitude to the environment. Its members recognize the high market value of an intact environment and the associated quality of life. Their attitude to combating climate change concentrates on the economic and other direct benefits of such policies. In their worldview, sustainability is feasible and desirable, especially when it relates to new technologies, high quality and efficiency. The principles of sustainability, and green innovation in particular, are welcomed as long as they are accompanied by such direct benefits as greater profitability, better health and tastier produce (Borgstedt/Schleer, 2019, 262). As Figure 9 shows, the established milieu's index values on environmental awareness are significantly weaker than the average values of the other milieus on all three parameters. While the average value of the total sample is 7.2 for the affective, 7.9 for the cognitive and 4.7 for the behavioral component, the established milieu‘s index values are 6.2, 7.1 and 4.3, respectively.

The established milieu's performance-oriented attitude to life is apparent in its level of environmental awareness, especially where agriculture is concerned. They are happy with modern agriculture since for them economic growth and competitiveness have the highest priority. Members of the established milieu are less likely than average to agree that agriculture should have as little impact as possible on the environment and climate. At 35 percent, the share of respondents who agreed that agriculture should in future burden the environment and climate as little as possible is 10 percentage points below the average positive response for all milieus. Moreover, less than half of established respondents (47 percent) chose protecting the environment and nature as the most important task of agriculture in our society, in contrast to the 68-percent response of the traditional milieu and the 77 percent of the critical-creatives. Table 4 gives an overview of these milieu-specific differences in the areas of energy, mobility, and food consumption.

Milieu-specific differences in selected areas of consumption

Positive responses in percent

Significantly underrepresented
Significantly overrepresented

	Milieu				
	Established	Middle class	Critical-creative	Traditional	Precarious
Energy					
The energy turnaround in Germany is progressing too slowly to protect the climate effectively.	32.0	31.0	69.0	42.0	41.0
Do you currently purchase green electricity?	38.4	37.5	59.2	42.0	32.6
I regularly check the consumption of my appliances with an electricity meter.[1), 2)]	17.5	18.3	19.8	15.5	21.0
I find it too tedious to check my electricity consumption or I do not know how to check the consumption of my appliances.[1), 2)]	58.8	53.8	59.1	72.4	73.4
Mobility					
Use of a car daily or several times a week	82.0	82.0	68.0	72.0	70.0
Use of public transportation daily or several times a week	17.0	11.0	24.0	15.0	20.0
Public transportation must become much more cost-effective.[1), 2)]	89.1	94.7	93.8	92.4	97.0
Car sharing is a good alternative to owning a car.[1), 2)]	47.0	53.4	70.8	61.5	65.4

The established milieu is also significantly less ecology-minded when it comes to mobility. Clearly, the automobile is for them not only a means of transportation but also a symbol of progress and economic performance. Members of the established milieu make most use of their own auto, with 82 percent of those surveyed using their car daily or several times a week – a figure matched only

	Milieu				
	Established	Middle class	Critical-creative	Traditional	Precarious
Food consumption					
For the future of agriculture, it is most important that the environment is not polluted and the climate does not become warmer.	35.0	41.0	61.0	39.0	44.0
How many of the goods you purchased last month were organic? [2), 3)]	35.0	26.7	51.2	35.1	26.0
Have you ever had a consistently vegetarian or vegan diet?	24.9	21.2	43.1	25.7	28.2
I am willing to spend more money to have environmentally friendly products.[2), 4)]	28.7	11.4	65.9	20.5	13.3
Have you ever foregone packaging and instead taken your own bags, jars etc. for grocery shopping?	56.7	57.1	71.4	54.3	47.1

1) Percentage of members of the respective milieu who answered this question with "totally agree" or "tend to agree".

2) Authors' own calculations based on data provided by BMU/UBA, 2020.

3) Authors' own calculated mean values of the percentage ranges (0, 1–10%, 11–20%, 21–30% etc.) of the share of organic products of the food purchased in the last month.

4) Percentage of members of the respective milieu who answered this question with "totally agree".

Sources: authors' own table based on BMU/UBA, 2019, 24 f., 37 f., 52 f.,64 f.; BMU/UBA, 2020

by members of the middle-class milieu – while only 17 percent claimed to use public transportation so frequently. Moreover, the established milieu has the highest rate of automobile ownership. 47 percent of surveyed members own two cars and 12 percent three or more. In contrast to the traditional milieu (10,000 kilometers per year on average), the automobiles owned by the estab-

lished milieu cover distances of 20,000 to 40,000 kilometers per year (BMU/UBA, 2019, 76). Furthermore, the established milieu is significantly less enthusiastic about car-sharing. Asked whether it is a good alternative to owning a car, less than half (47 percent) "totally agreed" or "tended to agree", in contrast to the 70.8 percent of the critical-creative milieu who responded to this statement positively (BMU/UBA, 2020; authors' own calculations). Where energy consumption is concerned, only 38.4 percent of the established milieu's respondents reported currently buying green electricity, while almost 60 percent of the critical-creative milieu claimed to purchase energy from renewables.

All in all, then, members of the established milieu tend to be less ecology-minded than other milieus. Given the considerable potential for more sustainability within this milieu, how can its members be better addressed and encouraged to behave more ecologically? Since they have a basic environmental awareness and no significant aversion to sustainability for price reasons, a suitable nudging technique might be the use of green power defaults. While the price premium of green energy is a potential deterrent for the price-sensitive middle class and the low-income precarious milieu, it is unlikely to be a significant barrier for the established target group. For this reason, the proportion of consumers who accept the default can be expected to be higher among the established milieu than within lower-income milieus.

Further, when designing an environmental policy tool for this target group, consideration should be given to the established milieu's pronounced interest in new technologies, high quality, and efficiency. Members of the established milieu are particularly interested in engaging in sustainability when it is financially worthwhile for them, as might be the case with investments in energy efficiency or high-yield sustainability projects. Moreover, they are particularly receptive to topics involving a pioneering role, such as smart-home technologies or electromobility. Here, recommending the use of smart meters with optical feedback mechanisms (see 3.2.1) might be an appropriate nudge for this technology- and efficiency-driven milieu.

Additionally, as we have seen, there is still considerable potential for improving sustainable behavior among the established milieu in the field of mobility. Instead of enacting blanket bans on the use of automobiles, which could prove

counterproductive in light of this milieu's liberal values, the established milieu can be motivated towards more sustainable transportation choices through smart nudging techniques, such as an application which provides feedback on fuel-efficiency and driving style (see 3.2.1). In view of this milieu's high interest in new technologies and economic efficiency, a device designed to save fuel consumption without limiting their freedom is likely to appeal to established drivers. Given the milieu's preoccupation with success, this could be combined with a goal-setting nudge involving a precise fuel-saving target.

4.2 The middle class: social comparison and short-term feedback

Members of the middle class are mostly of medium social status and predominantly in the 40-to-70 age group. The middle class's concern to belong and be integrated and simultaneous fear of social decline leads to a readiness to work hard to maintain their status. For most respondents from this milieu (75 percent), household monthly net income is between 1,500 and 4,000 euros (BMU/UBA, 2020; authors' own calculations). Security and harmony in private life are very important goals for the middle class. Moreover, they have a strong desire to be well-regarded among friends and acquaintances, in the neighborhood, and in society as a whole. Consequently, members of the middle class are particularly receptive to the bandwagon effect (see 2.2.1). Middle-class consumers have pronounced convenience requirements and are strongly focused on a good price-performance ratio. They are correspondingly sensitive to possible restrictions or price increases, a trait which makes them particularly receptive to liberal, non-restrictive tools such as nudging.

For the middle class, the protection of nature is certainly important and this milieu has a basic environmental awareness. However, the environment and the climate are not among its most pressing problems, with 76.7 percent of respondents considering ensuring social justice a more important task (BMU/UBA, 2020; authors' own calculations). Figure 9 shows that the middle class's environmental awareness is weaker than the average on all three parameters, scoring 6.7 for affect, 7.7 for cognition and 4.3 for behavior compared with the total sample averages of 7.2, 7.9 and 4.6, respectively. With their insistence on comfort and convenience and their high price-awareness, members of the

middle-class milieu tend to be open to ecological consumption as long as it does not bring extreme price disadvantages. Here, the middle class can experience dissonance in their consumption behavior (see 2.2.1) as their aim of acquiring inexpensive and convenient everyday products conflicts with their intention to act sustainably. In the survey, only 11.4 percent of middle-class respondents totally agreed that they were willing to spend more to have environmentally-friendly products (Table 4). This is in stark contrast to the 65.9 percent of the critical-creative milieu who are willing ("totally agree") to spend more on ecological nutrition. Animal protection and animal welfare are clearly of concern to the middle class, with a total of 93.5 percent of respondents agreeing with stronger regulations for animal welfare in livestock farming, 57.7 percent "totally" and 35.8 percent "tending to" (BMU/UBA, 2020; authors' own calculations). Yet despite this awareness of the sustainability problems in agriculture, the availability of inexpensive food has an even higher priority for this milieu.

The middle class are joint most-frequent car-users with the established milieu. 82 percent of respondents use their automobile daily or several times a week. At the same time, the middle class is the milieu which uses public transportation least frequently. Only 11 percent reported using public transportation more than once a week, a share even lower than that of the established milieu. The usual annual distance traveled by middle-class cars is 20,000 to 30,000 kilometers, several times that of the traditional milieu (10,000) but similar to the established milieu's annual average of 20,000 to 40,000 (BMU/UBA, 2019, 75 ff.). Where energy is concerned, the middle class places particular emphasis on electricity remaining affordable, with 74 percent regarding this as "very important". Moreover, almost half of respondents in the middle class (45 percent) regard the costs of Germany's transition to renewable non-nuclear energy as being insufficiently fairly distributed. On the positive side, there is a strong willingness to renew energy systems to save costs and the middle class finds energy-saving refurbishment of residential buildings very attractive (BMU/UBA, 2019, 77). Overall, then, the middle class's environmental awareness is dominated by an interest in keeping energy costs low.

The combination of the middle class's determination to save energy costs with its high interest in social status suggests that appealing to social norms in the form of neighborhood competition in energy consumption would be an

appropriate nudging technique for this target group. An intervention taking the form of behavioral electricity bills providing utility customers with feedback on their own energy consumption in comparison to that of their neighbors (see 3.2.1) should lead to significant reductions in energy use. A similar appeal to social norms could nudge members of this milieu to save water.

Moreover, as suggested by the data in Table 4, great energy-saving and CO_2-reduction potentials are to be found in the middle class's transportation habits. Given the middle class's distinct price sensitiveness and aversion to restrictions, feedback mechanisms such as providing drivers with information about their fuel-efficiency and driving style are likely to prove particularly effective. This is the same nudge as recommended for the established milieu, but for the middle class it would be particularly effective to inform automobile owners about the fuel costs incurred after every ride. The reason for this is the tendency to feel more pain after continual small losses than after a considerable one-time loss, even if the total amount is the same (Van den Assem, 2013, 1). As car drivers, members of the middle class normally only face a single large loss when the car needs to be refueled, while between fill-ups there seems to be no cost at all. By displaying the cost of each individual ride either on the car's dashboard or through a smartphone application, the driver's evaluation horizon can be narrowed. While the implementation of this nudge imposes neither extra taxes nor any other constraints on freedom of choice, it would result in "[…] cost savings for the driver himself (and more physical exercise when he uses his bike or walks instead), less crowded roads for other drivers, and less carbon emission for the benefit of all" (Van den Assem, 2013, 1 f.).

4.3 The critical-creative milieu: a car-sharing nudge and food choice architecture

The critical-creative milieu is an ecologically-concerned and particularly committed social group with a relatively broad age spectrum ranging from 30 to 70 years, intermediate and higher formal education and medium to high incomes. The net monthly household income of 61.8 percent of respondents lies between 1,500 and 4,000 euros and of 28.7 percent between 4,000 and 6,000 euros (BMU/UBA, 2020; authors' own calculations). The critical-creative milieu's attitude to life is to ask critical questions and live responsibly and

meaningfully. Members of this milieu tend to be enlightened, cosmopolitan and tolerant, with a fundamentally post-materialistic orientation. They see themselves as the critical conscience of society and have a great interest in social and cultural issues (BMU/UBA, 2019, 15, 79). With a share of 60 percent, women are considerably overrepresented in this milieu.

According to the critical-creative milieu, environmental protection and climate action are currently not being addressed sufficiently in Germany. Only 4 percent of respondents believe that the federal government is doing enough or more or less enough in this respect. Only 1 percent of critical-creative respondents are satisfied with manufacturing industry's contribution to environmental protection and climate action, yet 82 percent consider progress in these areas as essential for safeguarding our future prosperity (BMU/UBA, 2019, 24 f.). As Figure 9 shows, the responses on all three parameters of environmental awareness are significantly higher for the critical-creative milieu than for the other milieus, making it the most environmentally-conscious of all five examined in this analysis. While the average value for the total sample is 7.2 for the affective, 7.9 for the cognitive and 4.7 for the behavioral component, the critical-creative milieu returns values of 8.7, 9.0 and 6.1, respectively.

In all three areas of consumption shown in Table 4, the critical-creative milieu behaves more sustainably and is more ecology-minded than the average. This is especially true of the food sector, where with 51.2 percent they have the highest average share of organic products purchased in the last month, compared with only 26.7 percent for the middle class. The proportion of respondents from the critical-creative milieu who have already tried a vegetarian or vegan diet (43.1 percent) is also considerably above the average (28.6 percent) (BMU/UBA, 2020; authors' own calculations). Here, the greatest contrast is again with the price-sensitive middle class, where only 21.2 percent have tried avoiding meat and/or other animal products. Again in contrast to the middle class, and here also to the low-income precarious milieu, 65.9 percent of critical-creatives report a readiness to pay more for sustainable products, making clear that the price premium for organic products is no great barrier for them. Members of the critical-creative milieu are also more often willing to take their own bags and jars with them for their grocery shopping and to buy unpackaged food. In addition, 61 percent of critical-creatives, as opposed to an overall average of

45 percent, agree that agriculture should have as little impact as possible on the environment and the climate; 86 percent of those surveyed see providing the population with a variety of high-quality and healthy foods as one of the three most important tasks of agriculture in our society; 77 percent hold agriculture responsible for environmental protection and nature conservation. However, no respondent from the critical-creative milieu regards producing low-cost food as one of farmers' three most important tasks (BMU/UBA, 2019, 37, 52 f.).

In energy consumption, the critical-creative milieu is the pioneer of green electricity purchasing, with a share of 59.2 percent of respondents answering positively. By contrast, only 32.6 percent of the precarious milieu and 37.5 percent of the middle class currently purchase green energy (Table 4). Moreover, critical-creatives (68 percent) are more likely than the average (50 percent) to consider a rapid and significant decrease in greenhouse gases as the most important aspect of Germany's energy transition, whereas this applies to only 39 percent of the traditional milieu. Members who think that the energy transition is progressing too slowly to effectively protect the climate are significantly overrepresented in the critical-creative milieu (69 percent), as the average for the total sample is only 43 percent.

As might be expected, sustainable mobility also has a high priority for critical-creatives, with 66 percent regarding it as most important that the future development of transportation spares the environment and climate as much as possible (average for all milieus: 40 percent). The proportion of the milieu who use public transportation daily or several times a week (24 percent) is more than twice as high as in the middle class (11 percent) (BMU/UBA, 2019, 64 f.). Moreover, 70.8 percent of critical-creative milieu respondents consider car-sharing a good alternative to owning an automobile. However, a significant proportion of them (68 percent) still use their own car more than once a week (Table 4). The critical-creative milieu is thus open to environmentally-friendly means of transportation but as yet without a fundamental renunciation of the automobile.

Despite the critical-creative milieu's above-average environmental awareness and pioneer position in sustainable behavior patterns where nutrition and energy are concerned, there is still considerable potential for improvement,

especially in sustainable mobility. Here, the milieu's high acceptance of car-sharing can be harnessed to design a simplification nudge, such as internet platforms to facilitate carpooling for commuters.

Further, this milieu's general openness to vegetarianism and veganism can be exploited by changing the choice architecture of food displays. Small changes, such as making the vegetarian dish more salient by switching the order and presentation of the dishes on the restaurant menu or making vegetarian dishes more conspicuous in self-service canteens, should suffice to prompt members of the critical-creative milieu to decide for the more climate-friendly food option (see 3.1.2).

4.4 The traditional milieu: intuitive feedback and default settings

The traditional milieu consists of the war and post-war generations who are largely over 70 years of age. As Figure 8 makes clear, this group includes people of varying social status. The majority of respondents in this milieu (75.9 percent) belong to households with a net monthly income of 1,500 to 4,000 euros. 16.1 percent, however, belong to lower-income households with net incomes of less than 1,500 euros per month, while 8 percent of households in this group enjoy net monthly incomes of 4,000 to 6,000 euros (BMU/UBA, 2020; authors' own calculations). Despite these differences, members of this milieu share a basic adherence to traditional values. Their slogan "Hopefully everything will stay the same" expresses a desire to preserve what is familiar to them, such as social order and the natural world. Security and stability are very important for traditionals, who thrive on routines and rituals. Accordingly, they evince a great aversion to change and a less pronounced willingness to embrace the new or the unfamiliar (Borgstedt/Schleer, 2019, 263).

For the traditional milieu, environmental and climate protection is an important topic but not their top priority. According to the Federal Environmental Agency's survey, 87.5 percent of traditional respondents consider social justice more important and 75 percent insist that combating the causes of migration should have priority over sustainability issues (BMU/UBA, 2020; authors' own calculations). However, with a value of 8.1 the traditional milieu shows an

above-average level of cognitive environmental awareness (Figure 9), suggesting a concern about the environmental conditions under which future generations, including their own children and grandchildren, will have to live. In matters of mobility, traditionals behave slightly more sustainably than the other milieus. 87 percent of households have at least one car, though it is usually driven less than 10,000 kilometers per year, a moderate distance compared with that clocked up by the established milieu (30,000 to 40,000 km) and middle class (20,000 to 30,000 km) (BMU/UBA, 2019, 75 f.). Moreover, members of the traditional milieu are above-average e-bike users (BMU/UBA, 2020; authors' own calculations), with 11.6 percent using electrically-powered bicycles daily or several times per week, almost double the proportion in the middle class (5.3 percent).

That traditionals support Germany's energy transition is suggested by the 58 percent of respondents who completely agree that it is acceptable if individual branches of industry need to be restructured for the transition to renewables. By contrast, only 36 percent of the middle class and 35 percent of the precarious milieu respond in this way. However, some traditionals remain skeptical about the energy transition, with half of respondents (50 percent) completely agreeing that the costs of the energy transition in Germany are distributed too unequally, and 79 percent considering ensuring an affordable energy supply for all to be very important (BMU/UBA, 2019, 38).

Despite their relatively pronounced environmental awareness (see Figure 9), traditionals see few opportunities to contribute to environmental and climate protection themselves, especially when it comes to energy consumption. Only 15.5 percent of respondents from the traditional milieu "totally agree" or "tend to agree" with the statement "I regularly check the consumption of my appliances with an electricity meter", meaning that the overwhelming majority fail to monitor their energy use. This may be explained by the advanced age of this group: 72.4 percent say that they either find it too tedious or do not know how to monitor their appliances' use of power (Table 4).

To overcome this specific barrier to ecological behavior, we recommend for traditionals the use of feedback mechanisms in the form of smart meters with visual displays and intuitively designed thermostats. This nudge, a simpler

and more convenient way of monitoring energy consumption (see 3.2.1), can enhance consumers' awareness of their power usage and thus encourage a reduction. In addition, as there is a basic willingness to act sustainably but a lack of knowledge of how to do so, green power defaults can be recommended as a behavioral intervention for this target group. The traditionals' aversity to change suggests a susceptibility to inertia and the status quo bias, meaning that they are likely to stick with the default options initially offered. However, for the lower-income groups within the traditional milieu, the cost difference between grey and green electricity may be too great, raising the likelihood that they opt out of default eco-tariffs for their energy.

4.5 The precarious milieu: reducing consumption and costs

The precarious milieu mainly consists of individuals with unskilled jobs in the low-wage sector and recipients of state transfer payments. This milieu includes several age groups with limited formal education. For most respondents (82.6 percent) the monthly net income of their household is between 500 and 2,000 euros (BMU/UBA, 2020; authors' own calculations). In daily life, the precarious milieu is strongly oriented towards the present: its members concentrate on coping with their daily routines and their attention is focused on everyday worries.

An overwhelming majority of respondents (86.1 percent) are more concerned about securing social peace than about environmental and climate protection, with 80.5 percent of respondents in the precarious milieu stating that social justice should take priority over sustainability issues (BMU/UBA, 2020; authors' own calculations). In terms of environmental awareness, their values for environmental affect and cognition (7.0 and 7.9, respectively) are very close to the average for all milieus (7.2 and 7.8, respectively) but their value for environmental behavior (4.0) is significantly lower than the all-milieu mean (4.7) (Figure 9). The discrepancy between knowledge and feelings, on the one hand, and actual environmental behavior, on the other, is particularly pronounced within this milieu. The average results for the first two parameters of environmental awareness suggest that members of the precarious milieu generally understand the importance of sustainability issues. However, less

than half of those interviewed (46 percent) regard adequate environmental and climate protection as essential for safeguarding prosperity, whereas 82 percent of critical-creatives agreed with this statement (BMU/UBA, 2019, 25). Precarious employment conditions, shift work or unemployment, family burdens and social isolation displace questions about the consequences of climate change in their attention (Borgstedt/Schleer, 2019, 263).

The precarious milieu is less convinced (62 percent) than the other milieus (e.g. critical-creative milieu: 86 percent, established milieu: 82 percent) that one of agriculture's most important tasks is to provide the population with a variety of high-quality and healthy foods, and indeed, the ecological problems of agriculture seem not to concern the precarious milieu in general. The aim of ensuring that the future development of agriculture burdens the environment and the climate as little as possible was mentioned by only 35 percent of respondents, compared with an average of 45 percent for the total sample and 61 percent for the critical-creatives (BMU/UBA, 2019, 52). Significantly fewer members of the precarious milieu (26 percent) had bought organic products in the previous month than had the members of the other milieus (51.2 percent), no doubt due to their lower average income and the price premium on organic products (Table 4).

When it comes to energy policy, the precarious milieu is less concerned with the environment and climate than with cost considerations and socially acceptable design. With 32.6 percent of its members buying green electricity in 2018, the precarious milieu is significantly underrepresented in the purchase of sustainable energy, especially compared with the 59.2-percent share of critical-creatives. A vast majority of respondents from the precarious milieu (81 percent) consider ensuring an affordable energy supply for all to be very important. Only a minority (35 percent) regard it as acceptable for individual branches of industry to be restructured as a result of the energy transition, while more than half (52 percent) completely agree that the costs of the energy transition in Germany are distributed too unequally (BMU/UBA, 2019, 38).

In view of these responses, the potential to encourage more sustainable behavior among members of the precarious milieu may appear limited. However, research conducted by the German Development Institute into how behav-

ioral insights can improve energy efficiency among low-income populations in developing countries gives grounds for optimism. The author of the study notes that "[…] different types of affordability exist that are influenced by behavioural factors to varying degrees" and that "[…] social preferences, framing and innovative financing solutions that acknowledge people's mental accounts can provide useful starting points" (Never, 2014). Certainly, environmental behavioral communication for the precarious milieu must ensure that the setting is inviting, sociable and pleasant. Instead of trying to motivate this group to buy more green electricity or to regularly purchase organic products which are often unaffordable, priority should be given to behavioral tools that aim at reducing consumption and thus also costs. In this way, the requirements of the fourth anchor of the behavior-based environmental economic toolkit, enabling, can also be achieved (see Figure 6). Given that 97 percent of the precarious milieu consider public transportation too expensive (see Table 4), an appropriate nudge for this target group would employ the simplification technique, for example an offer of free trials for public transportation to encourage more ecological transportation choices.

4.6 The milieus and air travel

With aviation causing much higher greenhouse gas emissions per passenger kilometer traveled than any other means of transportation, air travel is by far the most climate-damaging form of mobility. A round-trip flight from Germany to the Canary Isles, for instance, releases into the atmosphere about 1.9 tons of CO_2 equivalents per person. This is more than all the greenhouse gases that the average German citizen produces in a year through the use of car, bus and train (around 1.5 tons of CO_2 equivalents per person) (Umweltbundesamt, 2020d). This extreme difference between air travel and other modes of transport is due to the fact that emissions of CO_2 and other greenhouse gases at an altitude of ten kilometers have three times the effect that they would have on the ground. Since the merits of air travel are currently the subject of heated public debate, we here take a closer look at the different milieus' attitudes towards this mode of transportation, and examine the extent to which green nudges can help to motivate the footloose to fly less, donate to projects that offset their CO_2 emissions, or choose altogether more ecological travel options.

In addition to the five milieus described in sections 4.1 to 4.5 of this chapter, we here include the three younger milieus: the young idealists, the young pragmatists and the young skeptics. The members of all three are predominantly aged between 14 and 30 but, as Figure 8 shows, enjoy varying social status.

- The **young idealists** are mainly young metropolitan women and men with high formal education, with still low or no income but above-average parental incomes. For them tolerance, respect, diversity, sustainability, and environmental awareness are important topics. In addition to their commitment to social and ecological issues, a passion for travel and new experiences is characteristic of this group (BMU/UBA, 2019, 15).

- Among the **young pragmatists** adolescents under 20 years are clearly overrepresented. About two thirds are still in school while the remaining third have graduated and have a job. Most young pragmatists still live at home with their parents, many of whom have higher incomes. Like the established milieu, professional success and a high standard of living are important for this group, and they are keen consumers of state-of-the-art technology, cars, the latest fashion in clothes, and long-distance travel (BMU/UBA, 2019, 15).

- In contrast, the **young skeptics** are mainly basic secondary and middle school graduates. Both their own and their parents' incomes are relatively low and this milieu includes an above-average number of unemployed. Young skeptics are mainly interested in the price of products and, as the name suggests, are characterized by a certain skepticism towards political and social issues. As consumers, their demands are reduced to what they consider the basics: housing, clothing, entertainment, automobiles, and vacations (BMU/UBA, 2019, 15).

Table 5 gives an overview of how much the different milieus fly for leisure purposes and their awareness and willingness to take advantage of the possibility to make donations in compensation for their carbon footprint. It shows that in comparison to the average of the total sample, the three younger milieus travel especially frequently by air. All three younger milieus report flying more than the overall average of 0.68 flights, and more than any other group except the established milieu (1.01 flights). With an average of 1.27 flights, the young

The milieus and air travel

Table 5

Significantly underrepresented
Significantly overrepresented

Milieu	Number of round-trip flights taken for leisure purposes within the last 12 months (2018)	Proportion aware of the possibility of making compensation payments (%)	Proportion who have already made compensation payments (%)
Established	1.01	42.38	19.42
Middle class	0.45	22.75	12.61
Critical-creative	0.54	50.47	37.27
Traditional	0.53	25.95	25.61
Precarious	0.24	15.79	13.33
Young idealists	1.19	53.98	42.62
Young pragmatists	1.27	35.09	30.00
Young skeptics	0.77	29.35	29.63
Total	**0.68**	**33.27**	**26.53**

Sources: BMU/UBA, 2020; authors' own calculations

pragmatists clocked up the most trips by air in 2018 while, at 0.24, the precarious milieu's average number of flights was the lowest (BMU/UBA, 2020; authors' own calculations).

The younger milieus not only fly more, they are also, on average, better informed about, and more willing to make, carbon-dioxide compensation payments (Table 5). These are voluntary donations through which travelers can try to offset the effects of the greenhouse gas emissions caused by their flight. The money goes to specific climate protection projects, such as the planting of new trees. With 53.98 percent knowing about compensation payments and 42.62 percent having already donated, the young idealists are significantly above the total sample's averages of 33.27 percent and 26.53 percent, respectively. The lowest percentage with awareness of compensation payments is that of the precarious milieu (15.79 percent), while only 12.61 of the middle class have already made such payments. The latter figure is less than half of the average of the total sample (26.53 percent). The young idealists and young pragmatists are joined by the critical-creatives in having above-average

awareness of, and willingness to make, compensation payments (50.47 and 37.27 percent, respectively) (BMU/UBA, 2020, authors' own calculations).

Given their obvious scope for flight reduction and improvement potential in terms of compensation payments, what green nudges could motivate the relevant target groups to make more sustainable air transportation choices? A recent study shows that travelers can be encouraged to take lower-emission flights by providing them with information on the CO_2 emissions of alternative flight options while they are searching for, and booking, flights online (Sanguinetti/Amenta, 2021). The researchers asked 450 employees of the University of California, Davis to choose hypothetical flight options for university-related business trips on a website. The dataset included 7,593 round-trip or one-way flights and over 300 different destinations. In addition to the usual information, such as city and airport of origin and destination, airline and ticket class, price and number of layovers, participants were shown the selected flight's carbon emissions and emissions estimates for alternative flights, the lowest-emission flight being visually highlighted. They were thus given the chance to consider the flight's harmful effect on the environment among the other factors in the decision-making process (Sanguinetti/Amenta, 2021, 2, 4 f.).

To provide an example for flight-search companies which might be interested in emphasizing emission information, the study's implementers developed a demonstration flight search website called GreenFLY (https://greenfly.ucdavis.edu/) which "leverages choice architecture strategies to nudge consumers toward lower-emission flights" (Sanguinetti/Amenta, 2021, 4). By highlighting the lowest emission flight(s) with the label "Your GreenFLY", highly quantitative information was translated into categories (sustainable vs. non-sustainable flights) which increased salience and thus prevented potential air-travelers from overlooking sustainability-relevant information. By thus reducing cognitive processing and simplifying the selection process, consumers are enabled to interpret information more easily and respond more rapidly and emotionally (Sanguinetti/Amenta, 2021, 4).

In the experiment the participants were asked to make a series of choices between round-trip flight alternatives differing in terms of cost, carbon emissions, layovers and departure airport. To increase the statistical validity of

the selection models, the hypothetical flights' destination, price and carbon levels were based on the university's actual air travel data and the experiment covered two scenarios: a medium-haul (domestic) and a long-haul (international) trip. The results of the experiment showed a strong willingness to pay for lower-emission flights at a rate of $184 per ton of CO_2 equivalents saved for a domestic trip and $250 per ton for an international journey. Moreover, the participants proved willing to pay $97 more for a nonstop (and thus lower-emission) flight from a less convenient airport than for a layover flight starting from their preferred departure point. The study's authors forecast that if the university adopted such a flight search website in its travel-booking portal, this would result in potential annual savings of 79 tons of CO_2 emissions per year (Sanguinetti/Amenta, 2021, 9 f., 11).

These findings demonstrate that the provision of specific and relevant information at the point of purchase in online flight search presents a great opportunity to help consumers to make more environmentally friendly air travel choices. Lower-emission flights are promoted in a non-freedom-restricting way. If online travel agencies such as Google Flights, Opodo or Swoodoo adopted this nudge, consumers could be enabled and motivated to choose more sustainable air travel options (Sanguinetti/Amenta, 2021, 3, 13 f.).

As explained earlier (see 2.2.1), the anchoring-and-adjustment heuristic is often used as a basis for evaluation, with a significant impact on the outcome. By using default amounts as anchors, this phenomenon can be exploited to nudge air passengers to pay CO_2 offsets. The potential of this intervention has been amply demonstrated by Székely et al. (2016), who examined the effect of anchors in the flight-booking process on the level of air travelers' CO_2 compensation payments. For the online experiment, three different web pages were created. Having been informed about the flight's destination on page one, the participants selected times for the outgoing and return flights. Airfares varied between 88 and 92 euros and for each scenario the participants had a budget of 100 euros to pay for the flight, with any remaining amount to be spent on carbon-offsetting. On the second page, the participants had to decide on a carbon-offset payment and on the last page the participant's donation and remaining payment were summarized. To examine the effect of setting a default value for offset payments on the amounts actually paid,

the rating scale was anchored at three positions: (1) the mid-point of the scale as the control condition, (2) 0 euro for the low treatment condition and (3) 12 euros, the maximum value on the scale, for the high treatment condition (Székely et al., 2016, 3 ff.).

The results of the study showed a clear causal relationship between setting default values for the donation scale and actual carbon-offset payments, as the proportion of the budget allocated to the donation increased with a higher default value. While in the low treatment condition (0 euro) the average relative donation was around 25 percent, it rose to around 38 percent when the anchor was the mid-point of the scale and to around 42 percent with the highest anchor value. These results confirm the power of defaults, verify the influence of anchoring-and-adjustment heuristics in the decision-making process and provide evidence that payment defaults can be used to nudge consumers to make carbon-offset donations (Székely et al., 2016, 5 ff.).

Given the young idealists' passion for travel, the young pragmatists' consumption of long-haul flights and their above-average awareness of, and willingness to make, offset donations, the payment default can be highly recommended as a nudge for these social milieus. In this way, they can be encouraged to compensate for their carbon footprint without limiting their freedom of choice. With their above-average record of making compensation payments and general sensitivity to ecological issues, the critical-creative milieu would also be an appropriate target group for this measure. However, the price premium for airfares which include a compensation payment will likely prove a barrier for the lower-income social milieus, such as the young skeptics and the precarious milieu, as well as for the price-sensitive middle class.

Like the green nudges presented earlier in this chapter (see 4.1 to 4.5), behavioral interventions aimed at air travel should focus on target groups where both the savings potential and the acceptance level are expected to be high. In the case of the young pragmatists, young idealists, established and critical-creative milieus these criteria apply to the 'providing information on CO_2 emissions from alternative flight options' and 'labeling the greenest flight during the online booking process' nudges and we therefore recommend using both measures with these four milieus.

4.7 The milieus and behavioral economic policy

The above milieu analysis has highlighted the heterogeneity of target groups and their varying environmental attitudes and expectations. The leading group, the established milieu, pursues sustainable choices only as far as they are compatible with their interest in economic efficiency, quality and technological progress. For the middle class, climate change is an important issue, but only inasmuch as their personal freedom is not restricted and sustainable choices do not entail significantly higher expenditures. The critical-creative milieu are keen ecological pioneers, seeing climate protection as a central concern with top priority and acting accordingly. The lower-income and older milieus are bound together by status quo thinking. While the traditionals see climate change as a challenge more for future generations than for themselves, members of the precarious milieu are preoccupied with everyday survival and fear the cost of climate protection measures.

These milieu-specific differences in environmental attitudes and behavior must be taken into account in the design of any effective and well-targeted environmental policy. While for the traditionals defaults such as standard eco-tariffs and more sustainable printer settings are promising because of their aversion to change and tendency to inertia, for the performance-, success- and technology-driven established milieu the goal-setting nudges and the use of high-tech feedback mechanisms can be recommended. For the socially-minded and price-oriented middle class, feedback on fuel consumption and costs and the nudge of neighborhood competition over energy or water use are likely to be effective. The existing sustainable behavior patterns of the critical-creative milieu can be further encouraged by means of a carpool nudge, green power defaults and changes in food displays. Finally, the under-resourced precarious milieu can be motivated to make more sustainable transportation choices by being offered free trials of public transportation.

All in all, the milieu model developed by Sociodimensions offers a good starting point for identifying and describing target groups, tailoring behavioral measures to their worldview and ensuring their appeal. On their own, a scientific understanding of environmental processes and technical descriptions of the consequences of climate change are not enough to initiate sustainable

change processes. Moving individuals, groups and even whole societies towards more sustainable behavior requires more than mere knowledge transfer. Correctly addressed environmental communication which takes account of real-life behavior is essential. The recommendations for milieu-specific green nudging elaborated in this chapter can be used as a guideline for the design of exactly this sort of target-group-oriented environmental policy communication.

5 Discussion and conclusion

5.1 Nudging as an instrument of ecological consumer policy?

The present analysis has demonstrated the effectiveness of nudges in several different environmental target areas. However, before final decisions can be made on the implementation of nudging as an instrument of ecological consumer policy, it is necessary to subject the nudge approach to critical reflection and discussion. Are there potential rebound effects? Has consideration been given to such critical factors as popular acceptance, political feasibility and cost? To what extent and under what conditions are decision-makers justified in incorporating behavioral insights into environmental policy? What ethical issues must be considered in this discussion?

5.1.1 Associated effectiveness and costs

"The most obvious strength of nudging is its compatibility with ideals of the free market. In an age when ideological preference for free markets and the increasing impact of globalisation on nation states limits policy makers' ability to regulate and tax in order to influence individuals' behaviour, nudging is a practical and more acceptable approach for politicians to try to solve pressing social and individual problems" (Mont et al., 2014, 29).

From the perspective of the person-in-the-street, nudging offers guidance in difficult decision-making situations without significantly restricting personal freedom. The nudge approach's low level of intervention depth (Figure 5) gives

it an important advantage over classical regulatory and economic environmental instruments (see 2.3.1). The practical application of any policy instrument, however, is primarily determined by its effectiveness. Our analysis of field experiments and studies (Chapter 3) has provided evidence of the effectiveness of green nudges and shown that behavioral interventions can be applied to a variety of environmental target areas. However, as our caveats have endeavored to make clear, nudging tools can be expected to show varying levels of effectiveness depending on the section of the population targeted.

A hitherto unknown variable is green nudges' long-term effects. Must we expect a nudge's effectiveness to rapidly decline after it has been removed from the individual's choice architecture, or will the effect of nudges remain even after the intervention has ended? In our model of the decision-making process (Figure 4), behavioral persistence can be achieved if the action that was initiated by the environmental policy tool is regarded by the addressees as successful, is continually repeated, and is thus established as a routine. The issue of behavioral persistence is well illustrated by the case study undertaken by Opower (see 3.1.2), in which the US energy software company sent home energy reports incorporating neighborhood comparisons to more than six million households nationwide (Figure 7). While the intervention led to significant reductions in energy use for some days after consumers received the reports, the effect dropped off so quickly that the study's authors initially estimated that it would totally disappear after a few months if the measure were no longer repeated.

However, over time the cyclical pattern of action and backsliding diminished. "After receiving the first four reports, the immediate consumption decreases after report arrivals are about five times smaller than they were initially", Alcott/Rogers (2014, 3004) explain. Among those who ceased to receive reports, some evidence of persistence was found as long as two years after discontinuation, but the effect decreased at a rate of 10 to 20 percent per year (Alcott/Rogers, 2014, 3003 f.). The researchers ascribed these long-term effects partly to a strengthening of habitual behavior as the HERs acted as a reminder to carry out daily energy-saving activities. However, they also led to a growth in physical capital as the energy reports encouraged the consumers to invest in equipment that produced long-term energy savings.

Nonetheless, households which continued to receive the reports achieved much better energy savings than those who stopped receiving the service. Indeed, the treatment effects in the third through fifth years were 50 to 60 percent stronger if the intervention was continued than when it was stopped (Alcott/Rogers, 2014, 3004 f.). Thus, although there was some evidence of behavioral persistence, the habit was clearly not fully developed after two years. Since the effectiveness of habit formation follows an asymptotic curve, it is essential to continue behavioral interventions until a habit is fully established (Michalek et al., 2015, 16).

Moreover, critics of behavioral interventions warn of the risk of rebound effects, which emerge when cost reductions from improved resource efficiency lead to increases in demand that partly or entirely offset the original savings. For instance, fuel efficiency improvements are often associated with cost savings, which can in their turn lead to more and longer car journeys and less use of public transportation or the bicycle. In addition to this direct rebound, there can also be other environmentally relevant changes in demand behavior. For instance, money saved on fuel could be spent on air travel or other environmentally harmful activities, an indirect rebound which might actually expand the individual's ecological footprint (Umweltbundesamt, 2019).

For this reason, nudging strategies should always be subject to strict cost-benefit analyses that include the possibility of rebound and other unintended side-effects. However, the fact that different behavioral instruments can be combined creates considerable scope for limiting undesired consequences. The additional setting of environmentally-friendly defaults is one such measure particularly suited to limiting the rebound risks associated with fuel-, energy- and resource-saving interventions (Semmling et al., 2016, 27). Since, in order to change the default settings, consumers must consciously occupy themselves with the new technology and the associated energy consumption, they will be tempted to stick with the original works setting, thus ensuring that the savings potential is fully exploited. In addition to the examples mentioned in section 3.1.2, an ecologically-friendly refrigerator temperature or the energy-saving program for dishwashers and washing machines can be set as standard, and automobiles programmed so that the air conditioner does not automatically start with the ignition (Semmling et al., 2016, 27).

Although applying psychological insights has the potential to generate more environmental protection relatively cheaply, the final decision as to whether nudging should be used as an instrument of ecological consumer policy must depend on a full evaluation of the final costs. Such an evaluation was carried out as part of a wider study commissioned by the Federal Environmental Agency, revealing an impressive price-performance ratio for the implementation of the green power default. The study considered 39.9 million households, of which 22 percent purchased green electricity, and assumed that 900,000 households per year switched suppliers, of which 69 percent participated in the intervention. It was estimated that 0.7 terra-watt hours of fossil energy would be replaced by renewable energy, resulting in annual savings of 488,063 tons of CO_2, 70 tons of NO_X and 168 tons of SO_2. For the conversion of the websites needed to implement the measure the Federal Environmental Agency estimated costs of 696,960 euros per year, a low price in relation to the potential benefit. Using similar calculations, the Agency found that smart meters, simplified access to public transportation and social household competition in water bills also offered a relatively good price-performance ratio (Thorun et al., 2017, 94 ff.).

While classical environmental instruments are usually relatively expensive, either for consumers, in the case of increased carbon taxes, fuel prices, etc., or for the state, in the case of green investments, green nudges can be a relatively cost-effective climate policy tool for both the nudged and the government in its role as decision architect. In a democracy such as Germany's, however, effectiveness and efficiency cannot be the only criteria; prior to the final implementation of any concrete nudge, questions about political feasibility and ethical issues must be added to the discussion.

5.1.2 Ethical considerations: FORGOOD

As we emphasized in Chapters 2 and 3, an important advantage of nudges is that they are not bans or prohibitions. After all, a nudge approach does not force diners to choose a vegetarian dish but simply encourages the appropriate selection with the help of visual highlighting. Driving bans and speed limits are equally contrary to the spirit of nudging (Piasecki, 2017), since more ecological driving can be achieved without them by means of fuel consumption feedback, for instance. Nor does more behavioral-economics-based environmental protection necessarily lead to more inequality. Indeed, the liberal nature of

nudging can benefit low-income groups indirectly – by relieving them of the additional financial burden placed on them by classical environmental instruments, such as environmental taxes – and directly – by encouraging lower expenditure through lower energy and resource consumption and the opportunity to trial public transportation.

However, considerable criticism has been leveled at certain nudges, especially those which impose a higher cognitive burden. Also, doubts have been expressed as to whether the freedom that the nudge approach and the concept of libertarian paternalism supposedly grant their targets really exists. This applies, for instance, to those who are unable to recognize the nudge or to resist default effects (Schubert, 2016, 27). Ethical nudging is generally considered to fulfil two criteria. It must offer freedom of choice without additional opting-out costs, and it must have the well-being of the individual as its ultimate goal. Experts refer to behavioral interventions which do not meet these criteria as 'dark nudging'. This negative form of nudging primarily involves strategies which motivate consumers to make purchases, to sign up for subscriptions or to order services they do not really want, or to disclose data they do not really want to share (Reisch, 2020, 87 ff.).

In an effort to reduce "the unintentional misusage of behavioural science in applied policy settings by encouraging voluntary ethical reflection in a systematic way" (Delaney, 2020) Leonhard K. Lades and Liam Delaney developed an ethical framework which they labeled FORGOOD. The acronym stands for fairness, openness, respect, goal orientation, opinions, options and delegation. Table 6 gives an overview of these key attributes and the questions which identify them. The framework is addressed to policy-makers to be consulted when designing an ethical nudge approach for behavioral environmental policies.

- **Fairness.** Fairness is a fundamental human concern and environmental policies in particular will not work if they are not perceived as fair. "The question of the fairness of green nudges is obviously highly relevant for the question whether it's politically feasible to implement these tools" (Schubert, 2016, 26). Nudge practitioners should measure the redistributive effects of their nudges and consider whether the proposed policy tool would change welfare on balance (Lades/Delaney, 2020, 4).

The FORGOOD ethics framework for nudging Table 6

Fairness	Does the behavioral policy have undesired redistributive effects?
Openness	Is the behavioral policy open or hidden and manipulative?
Respect	Does the policy respect people's autonomy, dignity, freedom of choice and privacy?
Goals	Does the behavioral policy serve good and legitimate goals?
Opinions	Do people accept the means and the ends of the behavioral policy?
Options	Do better policies exist and are they warranted?
Delegation	Do the policymakers have the right and the ability to nudge using the power delegated to them?

Source: Lades/Delaney, 2020, 4

- **Openness.** Political decision-makers should take into account the extent to which their behavioral policy is open or hidden. Ethical nudging is designed to be as transparent as possible, with information presented in an understandable and accessible way. Covert and manipulative methods, cunning design tricks or strategies that make information unnecessarily complex and deliberately confuse consumers must be avoided (Lades/Delaney, 2020, 5 f.). Policymakers are recommended to communicate the behavioral policy tool and its anticipated effects on individual behavior openly (Reisch, 2020, 87 ff.). Especially in times of increasing public skepticism towards German politicians' actions and decisions, as in the context of the Coronavirus crisis, transparent political communication and the consequent public trust in policy are crucial to the success of behavioral environmental policy interventions.

- **Respect.** Behavioral policies must respect those they target and their autonomy, dignity, freedom of choice and privacy (Lades/Delaney, 2020, 7).

- **Goals.** The goal of nudges created in the spirit of libertarian paternalism should be to make people's lives better, as judged by themselves (Thaler/Sunstein, 2008, 5). Instead of maximizing the nudgers' profits at the expense of those that are nudged, nudge approaches should improve public welfare (Lades/Delaney, 2020, 9).

- **Opinions.** As environmental attitudes differ from individual to individual, the public can also be expected to have different opinions on the ethical acceptability of nudges. During the design of green nudges, consideration should be given to the amount of disagreement bearable, and the extent of agreement and disagreement should be measured to assess the expected effectiveness of the behavioral tool (Lades/Delaney, 2020, 11 f.). One way to identify public opinion concerning nudges is to analyze surveys that directly ask whether or not respondents would accept the implementation of certain interventions.

- **Options.** Green nudges are one of several environmental policy options. Though traditional environmental tools have been accused of increasing inequality or of restricting freedom, this does not mean that they do not have a place in the environmental policy toolbox or that green nudges can entirely replace them. A green nudge should encourage ecological behavior, but it should not diminish support for classical environmental policy tools such as a carbon tax.

- **Delegation.** The last dimension of the FORGOOD ethical framework focuses on the relationship between the nudgers and the nudged, the public policymakers as decision architects and the citizens who are their targets. If nudging is to be ethical, it is important that the government's delegation of the power to nudge is legitimate and results from a fair and legal process (Lades/Delaney, 2020, 12 f.). Furthermore, in a free democratic society such as Germany's, the extent to which the state may (or must) intervene in the autonomy of its citizens must be clear. The use of nudging, like other political instruments, should not be seen in isolation from the political system and its constitution. Indeed, it should necessarily be subject to some form of parliamentary control (Reisch, 2020, 87 ff.).

To sum up, an ethical and legitimate use of nudging must meet a number of basic conditions. The goal of nudging must serve the welfare of the individuals targeted, as judged by themselves, and ultimately society as a whole. Nudges must pursue legitimate policy goals which preserve individual liberties and property rights. Nudges must be designed in such a way that no one is maneuvered against their will into a particular behavior by prohibitive exit costs

or invisible algorithms. Genuine freedom of choice, maximum transparency, and open communication are essential to the design of an ethically qualitative green nudge approach.

5.2 Conclusion: a mix of instruments

This analysis has shown that changing human behavior to combat the climate crisis requires a more differentiated perspective than either traditional economic theory or a purely legal approach. While traditional environmental policy instruments consider individuals as utility-maximizing and self-interested agents, the field of behavioral economics provides evidence that real-life human decision-making is subject to bounded rationality. Individual characteristics, cognitive limits, social factors, and group affiliations have a significant influence on our actions and decisions. All these must be taken into account in the design of environmental policy instruments. Behavioral environmental tools can make a significant contribution to closing the gap between theory and actual behavior in environmental policy. Green nudges can be implemented to promote greener behavior without restricting the voluntary nature of consumers' actions. Appropriate areas of application range from encouraging energy and water conservation and promoting more sustainable transportation choices to increasing sustainable food consumption and improving waste recycling. To maximize the potential behavioral impact and to minimize the risk of rebound effects, we recommend applying green nudges in an instrument mix and to combine cognition-, interaction- and incentive-based tools adjusted to different social milieus.

Green nudges have both a political and an ethical dimension, and combining maximum transparency with precise targeting is the key to creating an effective and ethically qualitative environmental policy intervention. From an ethical perspective, it is crucial to design nudges to be as transparent as possible and to ensure individual freedom of choice without prohibitive exit costs. Politically, it is important to realize that the legitimacy and efficiency of behavioral environmental interventions can be assessed differently by different groups. The generalization and transferability of predicted outcomes are thus always limited by the influence of social milieu on the efficacy and the acceptance of any particular behavioral tool. This means that environmental policy measures

are more effective and efficient if they are directed to segments of the population with similar problems and lifestyles, values, attitudes and behaviors. A lifestyle typology of social milieus can be used to identify such potential target groups. Green nudges should then focus on these groups and those areas of environmental and climate protection where they are most susceptible to influence, and where there is the greatest potential for improvement.

For the design of concrete implementation strategies, the reaction of different target groups to a wide range of green nudges must be further researched. With this in mind, we recommend creating a central database at the federal level to record both the positive and negative outcomes of specific behavior-based environmental policy instruments as a basis for expanding the environmental policy toolkit. This could be achieved, for instance, in combination with datasets such as SDG Tracker, which provides data on global progress towards the sustainable development goals from the Our World in Data database (Ritchie/Roser, 2018).

Green nudges have limits and cannot entirely replace the classical instruments of ecological consumer policy. Rather, we recommend that policymakers make use of green nudges as a potentially powerful extension to the classical environmental policy toolkit. Before being added to this toolkit, every behavioral environmental intervention must be subject to a strict cost-benefit analysis. The anticipated risk of rebound effects and the total cost of the intervention must be calculated and compared to the expected behavioral outcome.

In view of the more ambitious climate protection goals recently formulated and the ongoing lack of clarity among policymakers as to how exactly these climate goals should, and can, be achieved, an interdisciplinary approach incorporating the valuable insights of behavioral economics in combination with ethical knowledge should be used as an opportunity to encourage the adoption of more ecological behavior and thus to counteract climate change more effectively.

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Zusammenfassung

Der Klimawandel zählt zu den größten Herausforderungen unserer Zeit. Angesichts der kontroversen politischen und gesellschaftlichen Diskussionen rund um Verbote oder höhere Umweltsteuern für mehr Klimaschutz stellt sich die Frage, inwiefern verhaltensökonomische Erkenntnisse genutzt werden können, um das Klima mit weniger drastischen Eingriffen in die Freiheit und die finanziellen Ressourcen der Menschen zu schützen. Die Verhaltensökonomik liefert empirische Belege für eine Vielzahl an psychologische Faktoren (Heuristiken und Biases), die (nachhaltiges) Verhalten beeinflussen. Moderne verhaltensökonomische Anreizsysteme nutzen diese Erkenntnisse rund um den Einfluss von Einstellungen, Bedürfnissen und Erwartungen sowie die soziologischen Milieuzugehörigkeiten bei der Gestaltung von umweltpolitischen Instrumenten. Mithilfe von intelligenten und effektiven Green Nudges kann durch zielgruppenspezifische und moralisch vertretbare Maßnahmen Nachhaltigkeit bei Verbrauchern effektiv und effizient erreicht werden: Default-Einstellungen, soziale Vergleiche, Feedback-Prozesse oder Vereinfachungen richten sich differenziert an verschiedene Milieus, um den größtmöglichen Effekt zu erreichen.

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