Chapter 10
Attitude and Behavior Changes Through (e-)Participation in Citizen Panels on Climate Targets

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Abstract This chapter investigates attitudinal and behavioral impacts of (e-)participation in citizen panels collaborating with local governments in joint efforts to reduce CO_{2e} emissions. The e2democracy (e2d) project studied seven participation exercises with largely identical objectives and organization (a combination of long-term individual CO_{2e} footprint monitoring by the panelists, issue-specific information and events, and other opportunities for exchange over up to 2 years) in Austria, Germany, and Spain. In all panels, pro-climate awareness, attitude and behavior changes associated with the participation processes were observed, although to different degrees. In all but one region, the results showed a relatively strong positive link between attitude and behavior change. Attitudinal changes were greater than behavioral changes, which can partly be explained by the difficulties of changing social practices (e.g., nutritional habits) and local context conditions (e.g., transport options). An investigation of the causal mechanisms and mediating factors revealed moderate "gentle nudge" type effects from CO_{2e} footprint monitoring among panelists in all three countries. While a direct effect of community feeling on behavior change was not confirmed, a number of community-related factors, such as social learning and the removal of personal barriers through community support were positively related to behavior change. One conclusion is that attempts to change individual behavior towards pro-climate lifestyles through individual information feedback are more effective when they are embedded in a participatory community context.

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10.1 Introduction

Across disciplines, behavior change plays an important role in debates on climate change mitigation strategies (cf. Warde and Southerton 2012; IPCC 2007, p. 59). Although an exclusive emphasis on individual behavior is hotly disputed, mainly with reference to limitations by factors beyond individual control (cf. Shove 2010) and uneven attribution of responsibility (cf. Grunwald 2010), there is no doubt that established patterns of consumption contribute to climate change and hence cannot be neglected. The spectrum of strategies applied to change individual behaviors into sustainable consumption and climate-friendly practices includes education and awareness raising, appeals to values and ethical principles, regulations, incentives, social support, and the supply of climate-friendly products and services, all together constituting both informational and structural approaches (Steg and Vlek 2009).

Information-based instruments, in particular individual feedback on consumption records over time and in comparison to others, have become widespread in recent years, especially in the household energy consumption domain. According to Thaler and Sunstein (2008), offering a suitable "choice architecture" is a means of providing a "gentle nudge" towards energy-saving behavior. However, descriptive normative information can also have the unintended consequence of inducing individuals with consumption records below the norm to stop their saving efforts or even spend more. The extent to which this "boomerang" effect can be mitigated by special feedback designs (e.g., positive emoticons for CO_{2e}[1] emissions below average) is disputed. Existing evidence on the effectiveness of the attempts to change individual behaviors through feedback with the aim of reducing energy consumption is mixed (Rasul and Hollywood 2012). In a broad review of international experience, Fischer (2008) finds energy savings ranging from zero to over 20 % (most of them between 5 and 12 %); however, none of the 12 studies dealing with normative comparison could demonstrate an effect on consumption. Some of the gains in energy efficiency are also lost by various kinds of "rebound" effects (e.g., increased energy consumption due to savings from efficiency gains). According to a literature review, direct rebound effects in the residential sector are estimated to range between 0 and 60 % of the gains in energy efficiency, but there is very little evidence that direct and indirect rebound effects together exceed 100 % (IRGC 2013, p. 5; Santarius 2014, p. 117).

While in the past intervention programs primarily targeted individuals as consumers, recent literature has suggested placing more focus on the community level and engaging individuals in the role of citizens (Peters et al. 2010). Heiskanen et al. (2010) argue that communities are a more appropriate context to deal with crucial constraints of individual behavior change. In their study of four types of communities (place-based, sectoral, interest-based, virtual) they show that these are able to tackle, each to a different extent, four types of constraints: social dilemmas (encouraging individual efforts through visible contributions by others), social conventions

[1] CO_{2e} stands for carbon dioxide equivalents.

(challenging existing, deeply rooted social practices), lack of infrastructure (influence on creation of supporting infrastructure), and helplessness (empowerment by community resources).

Public participation is included among the key intervention strategies for encouraging pro-environmental behavior (Steg and Vlek 2009) and offers potentials which overlap with those identified for communities. The e2democracy (e2d) project (see Chap. 7) investigated the effects of community-level climate initiatives with a specific participation design. It combines (e-)participation of citizen panels with long-term individual and collective CO_{2e} monitoring in collaboration with local governments targeting a reduction of CO_{2e} emissions. Such participation processes were studied in seven municipalities in three countries: Bregenz and Mariazell region in Austria; Bremen, Bremerhaven, and Wennigsen in Germany; and Saragossa and Pamplona in Spain. Local governments or local partners organized, staffed, and managed these processes in contact with the e2d research team. Citizens could choose freely between the use of electronic media for participation ("onliners") and traditional media ("offliners"). Of 1159 participants in total at the time of registration, 73.9 % were onliners; by the time of the final periodic measurement their share had fallen to 50.3 %. The rationale behind this (e-)participation design was to provide for a collective process with specific features to create an awareness for climate-relevant effects and to turn individual commitments into effective climate protection. Individual carbon footprint monitoring by the panelists over up to 2 years was expected to enhance the understanding of the impacts of behavior in various spheres of life and provide guidance for changing behaviors into low-carbon practices in everyday life, supported by the experience of joint effort, social learning, and collective capacity building.[2]

Based on a special evaluation design (described in Chap. 7) for assessing the impacts of citizen panel participation in local climate initiatives, this chapter presents and discusses the results related to individual pro-climate behavioral change. Section 10.2 investigates the extent to which citizen participation in collaboration with local governments based on individual CO_{2e} monitoring and feedback led to behavior change. The evaluation approach proceeds from the assumption that behavior changes are triggered by an interplay of factors such as participation process effects and attitude changes as well as external influences from the local context to global level (such as the nuclear disaster in Fukushima or the financial crisis). Thus, Sect. 10.3 on attitude change and Sect. 10.4 on preconditions and causal explanations complete the picture on the impact of (e-)participation in citizen panels. Section 10.5 draws some conclusions. The data comes from the seven citizen panels in three countries and is mainly based on three waves of panel surveys. This allows an analysis of individual perceptions and changes at multiple points in time (at the beginning, midway through, and at the end of the process). For information on the changes with respect to CO_{2e} emissions we refer to Chaps. 11 and 12 as well as to Aichholzer et al. (2013).

[2] Cf. Gudowsky and Bechtold (2013) on the role of information and of learning processes in public participation processes.

10.2 Change of Climate-Relevant Behavior

The e2d project highlighted six relevant areas, which contribute to the individual effect on climate change: electricity (power consumption), water consumption, heating, mobility, nutrition, and consumer goods. Information provision and guidance on climate-friendly behavior in these areas supported by joint community action are expected to lead to "sustainable behavior." This basically means that individuals will act more climate friendly by changing their everyday behavior, for example, by choosing transport modes which cause less CO_{2e} emissions.

The causal mechanisms outlined in Chap. 7 may lead to individual behavioral changes and a decrease of personal CO_{2e} emissions. The main aim of this chapter is the analysis of *attitudinal* and *behavioral changes*. It should be noted that an increase of climate-friendly behavior does not necessarily lead to a decrease of individual CO_{2e} emissions. As we have seen in Sect. 10.1, the literature points out that various mechanisms (e.g., "rebound effects") may lead to an overall increase of CO_{2e} emissions, even when participants showed an increase of climate-friendly behavior in certain areas or activities. Moreover, behavioral changes vary with respect to potential CO_{2e} savings (reducing the number of flights would lead to by far greater savings compared to adjusting the refrigerator temperature). Furthermore, some behavioral changes are more likely than others. From an individual perspective, changing long-established practices such as nutritional habits is more difficult to achieve than, for example, switching the lights off. Therefore, CO_{2e} savings are analyzed separately in Chaps. 11 (individual level) and 12 (collective level).[3]

10.2.1 Range of Behavior Change in Individual Areas

In the third wave of panel surveys at the end of the participation processes (see Chap. 7, Sect. 7.8 for details), participants were asked on each of the six areas if they had made lasting pro-climate changes to their behavior. For each category, the survey provided between three (nutrition) and five (electricity, heating, consumer goods) items and participants could choose whether they had made no changes, whether they had already made changes before participating in the project or since then. Since the main point of interest is how the (e-)participation process changed individual behavior, a change in behavior before participation cannot be linked to the effects of the process. At the same time, a high level of environmental awareness and pro-environmental behavior before participation implies that some of the suggested changes had already been made and thus the number of changes since par-

[3] Important methodological differences between the data on CO_{2e} effects (via carbon calculator) and behavior change (via panel survey) need to be born in mind. They concern the nature of questions, level of measurement, and sample size: carbon calculator data are based on quantitative consumption measurements of 419 cases in total; relevant survey data contain qualitative measurements of extent and type of behavior changes from 316 to 333 respondents in total.

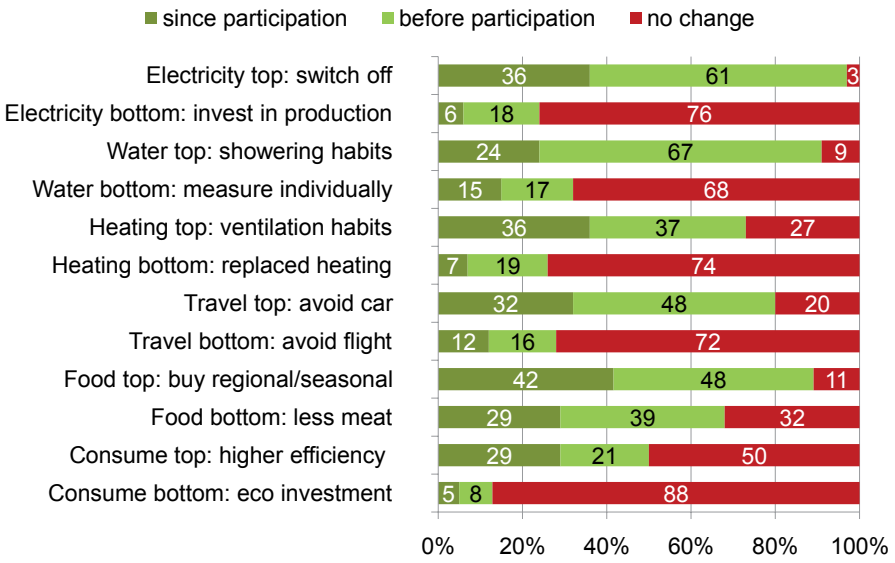

Fig. 10.1 Top and bottom items of behavior changes (in %; $n = 316–333$). (Source: Third survey of citizen panels)

ticipation is smaller for these participants (see Chap. 9, Sect. 9.5.2 on the composition of the panels with regard to their initial environmental awareness). Figure 10.1 shows the top and bottom items of behavior changes in each area.

In all areas we find both changes of individual behavior and a continuation of existing practices. While most citizens changed their behavior in activities that are within their decision-making scope and that are not too costly (e.g., switching off lights or consuming less water when showering), we see fewer changes to the status quo that involve higher costs (e.g., investment in new heating system with lower emissions) or of general social practices (e.g., avoiding flights for holiday-making). In the light of theories on the relationship between attitude and behavior and on the constraints of behavior change, this finding comes as no surprise. Generally speaking, behavioral changes are strongly linked to spheres of influence, costs of change, and lifestyle choices. According to the so-called low-cost hypothesis (Diekmann and Preisendörfer 1992) consistency between pro-environmental attitude and behavior depends on the material and immaterial costs of behavior change, measured in money, time, effort, and inconvenience. Similarly, lifestyle choices such as consuming meat or a (mainly) vegetarian diet are deeply rooted and therefore hard to change.

We see different patterns with respect to the areas mentioned. In areas relating to everyday routines, such as switching off appliances, improving ventilation habits, or buying regional and seasonal food, the magnitude of change during the participation is higher (costly, time consuming or more complex) than in one-off measures such as investing in clean energy or replacing flights by other means of transport.

10.2.2 Behavioral Change Across Areas

To give a condensed overview of behavioral changes in all six relevant areas, we created an additive index based upon the 26 items.[4] For each item we generated a dichotomous variable (0 for no change before participation, 1 for behavior change during the project). Since some activities and practices are more complex or costly to change than others (see above), each item was weighted by the effort needed to make the change as assessed by three members of the research team.[5] The higher the index, the higher the extent of overall individual changes made across all areas during panel participation (the maximum index value is 60).

Before we address the individual changes it is important to emphasize that two areas—food and consumer goods—particularly differ with respect to measurement precision in comparison to the other areas (electricity, water, heating, travel). Since quantitative measures in both areas (e.g., quantity of meat or duration of product use) are practically impossible, the design of questions in the surveys as well as in the CO_{2e} calculator followed a qualitative approach.

The key statistics for the additive index on the aggregate national level are represented in Table 10.1. As regards the *total change,* we see a rather similar pattern in all three countries.[6] Since participating in the panels, individuals changed their daily routines in roughly only a fifth of the change potential represented by the 26 weighted items. The mean value of behavioral changes ranges between 11.5 (Germany) and 12.8 (Austria). Since the standard deviation—the variation within each country—is rather similar for all three states, we can argue that we do not see different behaviors on an aggregate level. Both the means as well as the standard deviations are sensitive to extreme values, and therefore, the median is used to check for representativeness. In only two of the 21 cases (six different areas and the total change), namely the total change and traveling behavior in Spain, do we see relevant differences between the mean and the median, which indicates that extreme cases do not influence the presented statistical key figures to a relevant extent.

As indicated in Fig. 10.1, behavioral *changes* vary with respect to the areas of interest. However, the figures cannot be compared between areas since the number of items and maximum possible index values per area vary. In addition, when account is taken of the different levels of effort behind change by weighting the indices, we see that individuals changed their daily routines during the project more in some

[4] Citizens could also name other behavioral changes in the different areas. Between 8 and 12 % of all panelists mentioned additional changes (e.g., replacing windows, selling their car, handing on unused things to others).

[5] Weight factor 1: measuring water and electricity consumption of individual activities and easy changes (e.g., ventilation habits); weight factor 2: rather inexpensive changes in everyday routines (e.g., turn off standby appliances or buy seasonal or organic food); weight factor 3: rather costly changes and changes in life-style choices (replace energy guzzlers or eat less meat); weight factor 4: very costly, complex or inconvenient changes (e.g., replace heating system or avoid a flight).

[6] We decided not to use significance values as a criterion for interpreting differences as this does not seem meaningful with low case numbers in some cells. Instead we point out tendencies and note the significance of differences when the number of cases is sufficient and $p < 0.01$ or < 0.05.

Table 10.1 Index of pro-climate behavioral change since participation in citizen panels—national level. (Source: Third survey of citizen panels)

Country	Stats	Total change	Electricity	Water	Heating	Travel	Food	Consumption
Max. value		60	11	7	14	10	7	11
Austria	*Mean*	12.8	*2.5*	*1.0*	*1.8*	*2.1*	*3.0*	*2.4*
	Median	12.0	2.5	0.0	1.0	2.0	2.5	3.0
	SD	7.8	2.3	1.4	2.9	2.4	2.8	2.3
	N	42	42	42	42	42	42	42
Germany	*Mean*	11.5	*2.8*	*1.1*	*2.2*	*1.5*	*2.6*	*1.9*
	Median	11.0	1.0	0.0	1.0	0.0	2.0	2.0
	SD	7.5	2.2	1.6	2.8	2.0	2.6	2.0
	N	122	121	122	122	122	122	122
Spain	*Mean*	12.0	*2.8*	*1.6*	*2.4*	*1.4*	*2.0*	*1.8*
	Median	10.5	3.0	1.0	1.0	0.0	2.0	1.0
	SD	9.3	2.4	1.9	2.9	2.0	2.3	2.1
	N	170	170	170	170	168	169	169

Additive index of item scores and weight factors (see footnotes 2 and 3 for explanation)
SD standard deviation

areas than in others. Overall the index values indicate a higher degree of change in the fields of power consumption and nutrition while water consumption and transport habits changed less during the participation period. With respect to heating and general consumption, we find a medium-sized effect. However, it seems that the respondents tended to overestimate their perceived changes especially in the nutrition area, as these were measured by three items which tempted the participants to count even minor steps as changes made.

While the overall extent of changes does not differ between Austria, Germany, and Spain, the changes in the specific areas do. In Spain the extent of changes in the field of water consumption is significantly higher than in Austria and Germany. Water shortages had been an issue of concern in Spain during the years preceding the project, which very likely contributed to the participants' higher degree of efforts in this area. Austrian and German panelists had already practiced water saving to a larger extent before their participation. In mobility, nutrition, and consumer goods, panels in Austria show a higher degree of change than those in Spain and Germany. Austrians, however, did not change their heating habits during the project to a high degree as compared with Spain and Germany. Longer periods of lower temperatures in Alpine regions, particularly in winter, are part of the explanation. In the field of power consumption we do not see noteworthy variations within the three countries.

Table 10.2 shows how the different citizen panels at *regional level* changed their behavior during the participation process.

This analysis complements and confirms the general findings at national level. In six out of seven regions the overall mean of behavioral change during the participation process ranges between 10.1 (Mariazell) and 12.6 (Saragossa); only the index value for Bregenz is higher. This difference does not stem from a specific area of behavior change. Rather, we see the general trend that panelists in Bregenz changed their behavior during the process time frame in almost all areas to a greater extent than panelists of the other regions.

Within the countries we see the least differences between the regions in Germany, whereas in Austria the difference is striking. In contrast to Bregenz, Mariazell shows the lowest score (closely followed by Bremerhaven and Pamplona). The low level of changes in Mariazell can partly be explained by a more limited choice especially regarding heating and transport due to the geographical characteristics of the rural mountainous region with long, cold winters and insufficient public transport options. The age structure of participants also adds to the explanation: With roughly 62 % of participants aged 60 years or older, Mariazell started from rather low consumption levels in areas such as flights or general consumption, which means a lower potential for further reduction as a result of participation.

Like the findings at national level, Table 10.3 shows that mean and standard deviation are not biased by extreme values. In most cases the median is rather close to the mean, which indicates a non-skewed distribution. Only in Pamplona and Saragossa do we see a greater difference between mean and median in a few areas such as travel, which explains the slightly higher values of the standard deviation in comparison to the other regions.

While the differences in total change between the six areas of behavior change are rather small across the regions (with the exception of Bregenz), we see differences in behavioral changes between the regions in individual areas. *Power consumption*

Table 10.2 Index of pro-climate behavioral change since participation in citizen panels—regional level. (Source: Third survey of citizen panels)

Region	Stats	Total change	Electricity	Water	Heating	Travel	Food	Consumption
Bregenz	*Mean*	*15.5*	*3.1*	*1.2*	*1.5*	*3.2*	*3.3*	*3.0*
	Median	15.0	4.0	0.0	0.0	4.0	3.0	3.0
	SD	7.7	2.3	1.6	3.1	2.5	3.1	2.5
	N	21	21	21	21	21	21	21
Mariazell	*Mean*	*10.1*	*1.9*	*0.8*	*2.0*	*1.1*	*2.6*	*1.7*
	Median	10.0	1.0	0.0	1.0	0.0	2.0	0.0
	SD	7.1	2.2	1.3	2.9	1.9	2.5	2.0
	N	21	21	21	21	21	21	21
Bremen	*Mean*	*12.1*	*2.4*	*1.0*	*2.3*	*1.3*	*2.8*	*2.2*
	Median	12.5	2.0	0.0	2.0	0.0	2.5	3.0
	SD	7.4	2.3	1.6	2.8	1.9	2.7	2.0
	N	58	58	58	58	58	58	58
Bremerhaven	*Mean*	*10.3*	*1.8*	*1.2*	*2.6*	*1.5*	*1.8*	*1.5*
	Median	9.5	1.0	0.0	2.0	0.0	1.0	0.0
	SD	7.9	1.8	1.6	2.8	2.2	2.1	1.9
	N	24	23	24	24	24	24	24
Wennigsen	*Mean*	*11.4*	*2.1*	*1.1*	*1.9*	*1.8*	*2.8*	*1.7*
	Median	11.0	1.5	0.0	0.5	2.0	2.0	1.0
	SD	7.5	2.3	1.7	2.5	2.0	2.6	2.0
	N	40	40	40	40	40	40	40
Pamplona	*Mean*	*10.6*	*3.0*	*1.7*	*1.9*	*1.1*	*1.4*	*1.4*
	Median	9.0	3.0	1.0	1.0	0.0	0.0	1.0
	SD	8.0	2.3	2.0	2.5	1.6	1.8	1.8
	N	46	46	46	46	46	46	46

Table 10.2 (continued)

Region	Stats	Total change	Electricity	Water	Heating	Travel	Food	Consumption
Saragossa	*Mean*	*12.6*	*2.7*	*1.6*	*2.5*	*1.6*	*2.2*	*1.9*
	Median	11.0	3.0	1.0	1.0	0.0	2.0	2.0
	SD	9.8	2.5	2.0	3.1	2.2	2.5	2.2
	N	124	124	124	124	122	123	123

Additive index of item scores and weight factors (see footnotes 2 and 3 for explanation)
SD standard deviation

behavior changed to a greater extent among panelists in Bregenz, Pamplona, and Saragossa; the smallest changes were observed in Bremerhaven (1.8) and Mariazell (1.9), which corresponds to these panels' position regarding total change. A somewhat similar pattern can be observed in *water consumption*. A higher number of individual changes were made in both Spanish cities, while all other panels show a similar, low-sized effect. In Bremen, Bremerhaven, and Saragossa we find a high degree of behavioral change in the field of *heating* habits compared to the other panels. In the areas of *traveling* and *general consumption,* we see a greater behavioral change in Bregenz (significantly higher in the case of mobility), while all other regions have rather similar values. Higher differences between the regions are observed in the *food* sector. While in four regions (Bregenz, Bremen, Wennigsen, Mariazell) panelists changed several nutrition-related habits during their participation, we observe a noticeably lower effect in the other three panels.

One major advantage of panel data compared to one-time surveys is that it enables validity measures. When constructing the panel surveys, the inclusion of validity measures was a major objective. All data presented so far originated from survey 3 (at the end of the process). To check the validity of the individual behavior changes, we compare the weighted index from survey 3 to statements about behavior changes from survey 2 (during the process). In survey 2, one question was asked about individual behavioral changes in different fields. Unlike survey 3 which broke the six areas down into specific activities, in survey 2 respondents gave an overall answer on changes in five areas of interest (electricity, heating, mobility, nutrition, and general consumption). We can correlate these variables from both surveys,[7] expecting a higher validity if the correlation between both sets of variables is high. However, one has to keep three caveats in mind: Firstly, since a behavioral change between the second and the third survey cannot be ruled out, one should not expect a perfectly positive correlation. Secondly, the number of citizens varies considerably between the countries and panels, which is why the correlation figures refer to the national levels. Finally, from a statistical point of view, the number of cases is linked to the significance levels. The lower the number of cases, the greater the effect (in our case the correlation) must be to be significant. Since the number of panelists is rather low in Austria, we only find tendencies towards behavioral change in some areas as opposed to statistically significant results. Table 10.3 shows the correlation matrix for the areas mentioned.

Table 10.3 Validity scores for behavior changes—national level. (Source: Second and third survey of citizen panels)

Country	*N*	Power	Heating	Travel	Consumption	Food
Austria	35	0.40*	0.20	0.34*	0.24	0.53**
Germany	102–103	0.26**	0.38**	0.40**	0.07	0.29**
Spain	292–294	0.32**	0.43**	0.23**	0.21**	0.14

Spearman's rank correlation (between measurements over time) in $*p<0.05$; $**p<0.01$

[7] Except for water consumption since survey 2 did not contain information on this variable.

In 11 out of 15 cases we see a statistically significant correlation between the reported behavioral changes. If we consider the low number of cases in Austria, the number of cases in which we find a rather high correlation, and therefore a high validity, is 13. Only the general consumption habits in Germany and the changes with respect to nutrition in Spain do not show a significant positive correlation. Overall, these findings indicate that the identified behavioral changes associated with the participation process are valid.

10.3 Change of Climate-Relevant Attitudes

An important reference for explaining behavioral habits is the inclusion of attitudes. As stressed by political psychology (e.g., Krosnick 2002), attitudes are fundamental factors for the motivation, selection and prioritization of individual actions, although they are far from determining them. On the contrary, the existence of a value-action gap is also well known (Blake 1999). The panel surveys contain a variety of information on views about the relevance of climate change policies, on how individuals can act to minimize or prevent climate change, and detailed questions about issue knowledge and (possible) learning effects.

As outlined in the analytical framework in Chap. 7, providing information, guidance and individual and collective learning processes is expected to have an impact on awareness, attitude, and (under certain circumstances) on behavioral changes. Therefore, the following paragraphs give an insight into the magnitude of pro-climate attitude changes in the fields of relevance of the issue, the importance of climate-friendly behavior and possible impacts of collective efforts such as the collaborative participation exercises studied.

Individual behavior is based upon a complex setting of several factors. For a first insight we start with a selection of (possible) changes in some relevant fields. The third panel survey included items measuring change of attitudes and awareness such as the participants' attention to climate issues, interest in climate policy, comprehension of CO_{2e} effects, willingness to continue consumption monitoring beyond the end of the project, or their view on whether local climate initiatives such as in the e2d project have also strengthened participants' civic involvement. Respondents answered on a 4-point scale ("strongly agree," "tend to agree," "tend to disagree," "strongly disagree").

Figure 10.2 gives an overview of awareness and attitude changes. It shows that attitude-related changes were witnessed with regard to several of the dimensions in question to a rather high extent. Especially in the fields of issue saliency and awareness of individual actions—for example, as expressed by the motivation to continue energy consumption monitoring, a better understanding of CO_{2e} effects as a result of monitoring one's own behavior or by feelings of increased personal efficacy and interest in climate policies—a considerable percentage of respondents changed their attitudes over time. However, the magnitude of attitude changes varies. While

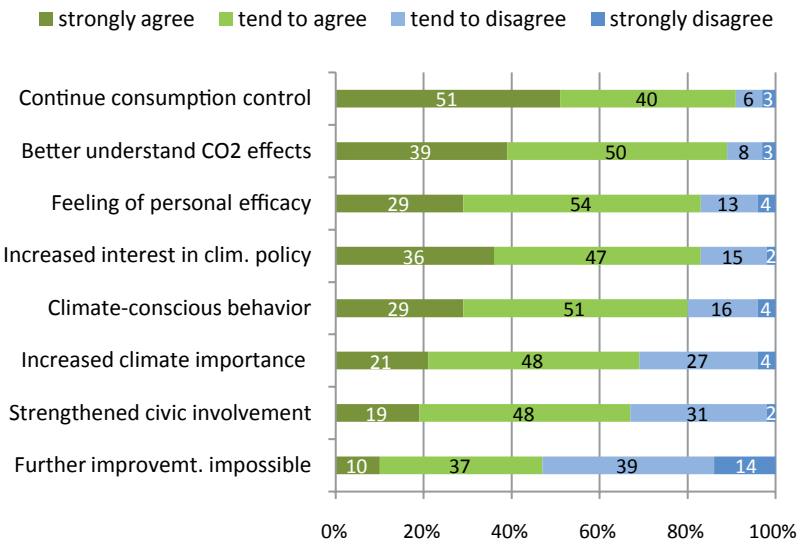

Fig. 10.2 Overview of awareness and attitude changes (in %; *N* = 323–333). (Source: Third survey of citizen panels)

nearly 90 % of all panelists now have a better understanding of the impact of their daily behavior on CO_{2e} emissions, for one out of three respondents the importance they attribute to climate change or civic involvement in this field did not increase. This is partly explained by the relatively high share of environmentalists among the participants, who already started with a high level of awareness at the outset. Furthermore, nearly every second participant saw hardly any possibility for further improvement of their personal carbon footprint. This might partly indicate a "boomerang" effect, that is, if participants achieve higher CO_{2e} reductions than the average or see a high decrease of emissions compared to other participants in one of the areas (as shown together with their individual CO_{2e} balance), their stance on the importance of climate change and future behavioral changes might lead them to a reduction of their efforts. However, partly it may also be due to reaching real limits to the further conservation of energy at the individual level.

What is of interest in addition to the overview of some fields of attitude change is its overall magnitude. For this purpose we again created an additive index based upon four key attitudes that reflect the versatile factors relevant to climate change. Survey 3 includes information on whether climate protection has become more important for panelists compared to other issues *(issue saliency),* whether the interest in environmental and climate policies has been strengthened *(interest in problem solutions),* whether panelists have a better idea about the dimension of CO_2 emissions caused by different behaviors (*awareness of effects*—relevant for the selection of possible actions), and whether they are attuned to act more climate-friendly since their participation *(motivation for sustained pro-climate behavior)*. With these

Table 10.4 Index of pro-climate attitude and awareness changes—regional level. (Source: Third survey of citizen panels)

Region	*N*	Mean	Median	SD
Bregenz	21	3.0	4	1.5
Mariazell	21	3.1	3	1.0
Bremen	56	2.9	3	1.3
Bremerhaven	24	2.9	3	1.3
Wennigsen	40	3.0	3.5	1.2
Pamplona	46	3.1	4	1.4
Saragossa	124	3.5	4	1.0

Additive index of attitudinal item scores (see explanation above)
SD standard deviation

four factors the index represents major components relevant to individual behavior in climate issues. For each question we built a dichotomous variable where 1 represents a positive change (i.e., higher relevance of climate protection) and 0 represents no changes (or negative changes if applicable) in individual attitudes. Given the diversity of the items, a higher value of this "attitude/awareness" index should be a good proxy for the general awareness and attitude change of panelists. Table 10.4 represents the key statistical figures for all seven regions.

Since the value for each panelist could range between zero and four, the degree of attitude and awareness change in all regions is relatively high; it is clearly above the level of behavioral changes. What also stands out is that the average level is more or less similar in all panels, except for Saragossa which shows a significantly higher degree of attitude change (a mean value of 3.5 and a remarkably small standard deviation). These results can be compared with those on the extent of behavioral change, where the Saragossa panel ranked second highest. There is a plausible explanation for this which speaks for the effectiveness of the exercise: The Spanish panelists and Saragossa in particular had shown significantly lower levels of information and interest in climate issues at the start and hence had a corresponding higher scope for change. However, the results on the extent of change in both criteria do not match for all panels. For example, in the case of Bregenz, Sect. 10.2 showed a significantly higher degree of individual behavioral changes among the panelists than in all other regions. The degree of attitude change is high but not as outstanding as in that of behavioral change.

Thus, the following interim conclusion can be made: Firstly, collaboration in climate initiatives leads to a high degree of attitude changes in a broad range of fields—from issue awareness to motivation for sustained behavior. Since these changes depend on characteristics of the participants and the local processes, the relatively low variation within the regions is actually remarkable. Secondly, a change in climate-related attitudes often precedes a pro-climate change in behavior. However, in the field of climate issues, too, attitude changes are not the only factor for behavioral changes, and attitude change does not necessarily translate into behavioral change to the same extent.

Table 10.5 Correlation between attitude index and different assessments of the climate project. (Source: Third survey of citizen panels)

Country	*N*	Overall assessment	Ineffectiveness	Meetings and events
Austria	38–40	0.49**	−0.52**	0.53**
Germany	114–117	0.53**	−0.26**	0.24*
Spain	141–170	0.35**	−0.17*	0.17*

Spearman's rank correlation coefficients
*$p < 0.05$; **$p < 0.01$

Again, checking the validation of the results on attitude change should substantiate these findings. All the questions used for the additive index are aimed at measuring whether the attitudes in certain areas have changed due to participation in the local climate initiatives. Therefore, we checked the view of the climate initiative as a whole, of its effectiveness and of the various events offered. Survey 3 includes corresponding questions. Since we would expect attitude changes to be based upon participation in the climate panels, panelists who have a high degree of attitude change should also have a positive *overall assessment* of the climate initiative as well as of its *effectiveness* and of its various *events*. Thus, we would expect significant correlations between the attitude change index and these variables. In the case of the effectiveness assessment—for reasons of questionnaire design—the statement used in a battery of items asked whether the participants agreed or disagreed with the statement that the initiative was ineffective, hence we expect a negative correlation. Table 10.5 shows the correlation between the attitude index and the validation variables.

In all three countries we observe the same tendency: The significant correlations indicate that citizens' attitude changes are linked to the participation process. With regard to the overall assessment we see that citizens with a higher extent of attitude changes also evaluate the climate initiative more positively. While there are no considerable differences between Austria (0.49) and Germany (0.53), the relationship is somewhat weaker in Spain (0.35). Since the overall assessment is a very general concept, more information could be gathered by comparing the attitude index to the effectiveness of the climate initiative as well as the evaluation of the information events.

Overall we see the same pattern in both aspects: The better the evaluation of the initiative's effectiveness and of its events the higher the number of attitude changes. Nonetheless, compared to the previous finding we see a considerable difference between the three countries. While the relationships are especially strong in Austria, the picture is less clear in Germany and Spain. However, an essential part of the differences between Austria and the other countries is due to statistical reasons. Since the number of panelists in Austria is rather low (the Spanish panel is four times bigger), each panelist in Austria has a higher impact on the correlation score than in Spain or Germany. In conclusion we could say that citizens who have a high degree of attitude change also have a positive view of the climate initiative, its effectiveness, as well as the assessment of the range of events offered, and vice versa.

10.4 Exploring Antecedents of Attitude and Behavior Change

As discussed in more detail in Chap. 7, impacts such as changes in climate-relevant attitudes and behavior are linked to a multitude of effects regarding activities, outputs and outcomes of the participation process. By observing processes over time the e2d evaluation approach makes it possible to investigate causal mechanisms and preconditions necessary for attitude and behavioral change. The aim of this section is to give an explanation for the magnitude of the changes we saw in Sect. 10.2 and 10.3 and proceeds as follows: Since we expect behavior change to be based upon a shift in attitudes or reinforcement of a pro-climate stance, we begin by exploring the relationship between attitude and behavioral change. We then investigate if and to what extent the hypothesized effects of the (e-)participation design rest upon two basic—individual and collective—mechanisms: (a) individual information feedback via the CO_{2e} calculator/book based on monitoring consumption behavior, including the possibility to compare one's own CO_{2e} emissions over time and with others and (b) integration within a collective process that supports the formation of a community, social learning, and capacity building. For this purpose we investigate a series of relationships using correlation figures. To begin with, Table 10.6 shows the relationship between the attitude and behavior indices we used in the previous sections.

As expected, the correlation between the degree of attitude and behavioral change is quite strong. Of seven panels, six show a significant connection between attitude and behavioral change ranging from 0.30 in Saragossa to 0.61 in Mariazell and Pamplona. This shows that a change in attitudes is often—but not necessarily always—followed by a change in individual behavior. It is important to highlight that we see noticeable regional differences in the relationship between both impact factors. While all German cities (Bremen, Bremerhaven, and Wennigsen) have the same degree of correlation, this pattern changes when we look at Spain or Austria. This indicates that local circumstances (i.e., the characteristics of the panel or the overall process; see Chap. 9) might increase or decrease the correlation between attitude and behavioral change. Bregenz is the only case that does not show the expected correlation. This can be explained by a combination of local panel and process characteristics: On the one hand, being the panel with the largest percentage of

Table 10.6 Correlation between attitude and behavioral change indices. (Source: Third survey of citizen panels)

Region	*N*	Rho
Bregenz	21	0.08
Mariazell	20	0.61**
Bremen	53	0.44**
Bremerhaven	24	0.43*
Wennigsen	39	0.43**
Pamplona	46	0.61**
Saragossa	123	0.30**

Rho Spearman's rank correlation coefficients
*$p < 0.05$; **$p < 0.01$

environmentalists, it started with the highest awareness and attitude levels regarding the need for climate protection, which left less scope for further increases; on the other hand, our data suggest that the relatively high extent of behavioral changes can be explained by the significantly higher levels of individual motivation and process support. Interestingly, as the relatively low community feeling among the Bregenz panelists indicates, the impetus for change seems to be largely individually based rather than being driven by collective mechanisms. These explanatory elements are empirically substantiated but not shown here in detail for lack of space.

10.4.1 Information Feedback Effects

As pointed out by Thaler and Sunstein's (2008) notion of the "gentle nudge," providing appropriate individual information feedback on a person's own energy consumption, together with the opportunity to compare personal outcomes with those of others, can serve as a trigger towards energy conservation. In the e2d project we expected that this combination of historical and normative information on a panelist's CO_{2e} emissions would have a similar potential to initiate a learning process and to stimulate a change of behavior towards more climate-friendly practices. Since the "gentle nudge" argument refers to a mixture of possible effects, the panel surveys include measurements on (1) the individual learning effects for climate-friendly behavior *(learning),* (2) whether the data provided has shown the relevance of personal consumption behavior for the individual CO_{2e} balance *(relevance),* (3) whether the data gives helpful hints on concrete starting points for behavioral changes *(guidance),* and (4) whether comparison with others encourages a reduction of CO_{2e} emissions *(comparison)*. Table 10.7 shows the correlation between the behavioral change index and these factors. As becomes clear in Table 10.7, in all three countries behavioral changes are to a certain degree linked to "gentle nudge" type effects. However, again the relationship varies within the countries where the panels were located. Before we move to details, it is advisable to keep in mind that due to the small number of cases we can only expect tendencies rather than significant figures in Austria. Regarding the overall learning effect from the continuous feedback of CO_{2e} data measuring individual behavioral consequences, we see a significant relationship with behavioral change in Germany and Spain. This illustrates that, in general, a higher degree of behavioral change is often accompanied by a

Table 10.7 Correlation between behavior change index and information effects. (Source: Second survey of citizen panels)

Country	*N*	Learning	Relevance	Guidance	Comparison
Austria	34–36	−0.02	0.32	0.25	0.25
Germany	102–103	0.24*	0.34**	0.29**	0.14
Spain	151–156	0.18*	0.09	0.08	0.17*

Rho Spearman's rank correlation coefficients
*$p<0.05$; **$p<0.01$

Table 10.8 Distribution of CO_{2e}-related information feedback index. (Source: Third survey of citizen panels)

Country	Index value	0	1	2	3	4	Total
Austria	*N*	5	13	9	8	6	41
	%	12.2	31.7	22.0	19.5	14.6	100.0
Germany	*N*	9	29	26	25	30	119
	%	7.6	24.4	21.9	21.0	25.2	100.0
Spain	*N*	17	32	44	65	15	173
	%	9.8	18.5	25.4	37.6	8.7	100.0

Additive index of information feedback item scores (see explanation above)

better understanding of its climate-related consequences. In terms of the relevance for personal consumption behavior and as possible starting points for behavioral changes (guidance) and their link to the behavioral change index, we see a convincing effect in Austria and Germany, whereas the Spanish panelists did not change their behavior on the basis of these factors. Finally, a comparison effect, that is, the encouragement of efforts through comparison with others is also present, although also showing rather weak relationships with behavioral changes.

While we have seen moderate relationships between the behavioral change index and general information feedback, the e2d panel data (survey 3) also provides information on the panelists' assessments of more specific aspects of the CO_{2e} footprint measurements: Whether continuous area-specific CO_{2e} footprint information was dispensable as a guide for where to change behavior, whether the possibility of comparing CO_{2e} footprints was important, whether comparative results of other participants led to increased efforts, and whether success in reducing CO_{2e} emissions motivated panelists to continue regular monitoring. For each question we created a dichotomous variable with 1 representing a strong information feedback effect (strongly/rather agree) and 0 representing no effect (rather not/do not agree). Based on these variables we generated an additive index which covers important dimensions of the "gentle nudge" hypothesis (maximum index value is 4). Table 10.8 displays the information index distribution across the three countries.

The pattern observed is similar to the previous findings in Table 10.7: CO_{2e}-related information effects could be detected in the panels in all three countries. The majority of all panelists show a medium or strong gentle-nudge effect (values 3–4). Nevertheless, we see that the figures for Germany and Spain are significantly higher than in Austria. This pattern is in accordance with the previous correlation between behavioral change and general information effects. In both cases the relationship is stronger in Germany and Spain, which suggests a somewhat lower role of information feedback elements overall in the Austrian panels, which can be explained by the comparatively stronger role of intrinsic motivation based on the higher percentage of environmentalists already mentioned above.

Table 10.9 Correlation between community feeling and behavioral change index

	t 1[a]		t 2[b]	
Region	*N*	Rho	*N*	Rho
Bregenz	19	−0.21	19	−0.03
Mariazell	17	0.05	15	0.33
Bremen	52	0.11	50	−0.06
Bremerhaven	22	0.03	22	−0.03
Wennigsen	32	0.15	32	0.28
Pamplona	43	0.30	38	0.10
Saragossa	113	0.04	116	0.09

Rho Spearman's rank correlation coefficients, *t 1* first measurement, *t 2* second measurement
*$p < 0.05$
[a] First survey of citizen panels
[b] Second survey of citizen panels

10.4.2 Social Learning and Community Effects

Since the literature shows that targeting individual consumers and using information-based approaches to change energy-related behavior achieves mixed results, Heiskanen et al. (2010) claim that a focus on the community level and the role of citizens would be more promising. The participation design established in the e2d project takes this into account and builds on collective local climate initiatives as joint efforts of major stakeholder groups. Citizen panels collaborating with local government were expected to provide the basis for community experience, social learning, social capital- and capacity building, which should support and facilitate behavior changes.

As an indicator of the extent of community building taking place, participants were asked twice about the extent to which they felt they were acting as part of a community: shortly after the start (first panel survey) and midway (second survey). Without showing the results in detail, the first measurement showed that between 35 % (Bregenz and Mariazell) and 75 % (Saragossa) of the panelists reported a very great or great extent of community feeling, and a substantial increase was observable in five of the seven panels at the second measurement. Interestingly, in Spain a higher level of community feeling developed with only a low number of face-to-face meetings. Assuming that strengthening social cohesion and that a mutual exchange between local communities would lead to an increase of individual efforts to mitigate climate change and also as a means of enhancing the backing, support and empowerment of individual intentions, we would expect that a higher degree of *community feeling* would also lead to a higher degree of behavioral changes. However, as Table 10.9 shows, at the time of the measurements we did not find a confirmation in terms of direct relationships.

At first glance, this finding might be surprising. The high share of onliners among the panelists (73.9 % at the start and 50.3 % at the end) and the remote nature of electronically mediated participation could be among the factors which work

Table 10.10 Correlation between social learning effects and behavioral change index. (Source: Second survey of citizen panels)

Country	*N*	Common issue learning	Exchange experience	Deliberation	Exchange good practice	Active contribution	Inclusivity
Austria	15–23	0.01	0.48*	0.34	0.32	0.05	0.20
Germany	49–57	0.27	0.13	0.23	0.01	0.26	0.24

Rho Spearman's rank correlation coefficients
*$p < 0.05$

against our expectations, but it seems more likely that community effects do not translate directly into behavioral change but are mediated by other elements. For strengthening the social coherence of a community the experience of face-to-face events and their frequency during the participation period are certainly helpful; however, the translation into pro-climate behavior depends on many more factors such as learning processes, exchange, and the backing of motivations for behavioral change.

In addition to community experience, we therefore take a closer look at social learning effects as another important causal mechanism for stimulating attitude and behavioral change. We assumed that providing opportunities for exchange and deliberation with other participants (e.g., at various events) can play a key role in this respect. To verify this, panelists were asked if (1) they had learned important facts at events *(common issue learning),* (2) if the exchange with others had revealed the importance of their individual behavior to them *(exchange experience),* (3) if they had learned from discussion with others *(deliberation),* (4) if they had learned from examples of climate-friendly behavior at events *(exchange good practice),* (5) if they took an active role in the exchange with others *(active contribution),* and (6) if their statements had been openly received by others *(inclusivity)*. Based on earlier research (see Chap. 7), we would expect a higher degree of behavior changes if the social learning and exchange practices were positively assessed.

The panel survey delivers information for Austria and Germany, but the low number of cases (about 50% less compared to similar analyses on country level in Table 10.7) means that we can only expect tendencies regarding social learning effects. As Table 10.10 shows, there is a statistically significant relationship, or at least a generally positive tendency, between social learning and the likelihood of the panelists' changing their behavior.

However, the results show that the magnitude of different effects varies at country and also at regional level. In Austria we see the tendency towards a higher degree of behavioral change as being linked to exchanging experiences with others, to deliberation, and to exchanging good practices at events. The strongest correlation values with behavioral change in Germany were found with regard to common issue learning and making an active contribution to the exchange with others. However, not all factors vary between Austria and Germany. In both countries deliberation with others seems to have an impact on behavioral change; the same can be said, albeit to a lesser extent, about a climate of inclusivity in the group.

Table 10.11 Correlation between community effects and behavior change index. (Source: Second survey of citizen panels)

Country	*N*	Barriers removed[a]	Efforts strengthened	Further community activities
Austria	31–39	0.20	0.42*	0.31
Germany	102–120	0.31**	0.12	0.21*
Spain	152–168	0.35**	0.14	0.06

Rho Spearman's rank correlation coefficients
*$p<0.05$; **$p<0.01$
[a] Third survey of citizen panels

While data on the social learning variables are missing for the Spanish panels in Table 10.11, we can compare all three countries with respect to one other important social learning aspect. In fact the *exchange on CO_{2e} footprints* with other panelists shows one of the strongest relationships of all the social learning effects to behavior change in all three countries: highly significant correlations[8] in the Spanish (0.33) and German (0.29) panels and also a positive tendency (0.24) in Austria. This finding also shows social learning effects in Spain which are in line with the previous findings for Austria and Germany. It suggests that the effectiveness of attempts to change individual behavior based upon information instruments profits from being embedded in a collective process and crucially depends on the regional and local implementation of the process.

Finally, a further question in the analysis of community effects is whether participation in collective climate initiatives and the strengthening of social cohesion supported the overcoming of barriers on the part of individuals (e.g., lack of transport alternatives, access to advice, financial support, etc.) and whether it strengthened individual and collective activities. If this was the case, we would expect a higher degree of behavioral changes to take place. The panel survey provides information on how participants evaluate the contribution of the collective initiative to alleviate (personal) *barriers* to pro-climate behavior, to strengthen individual *efforts,* and to enforce the importance of *further activities* against climate change.

Before looking at the relationship between community effects and behavioral changes, we provide a short descriptive overview. When asked to evaluate the general potential of a collective effort to alleviate individual barriers in the survey midway through the process, the majority of the panelists in all cities gave very positive assessments. To the same extent, panelists agreed that the common initiatives also strengthened their individual efforts to change climate-relevant habits. In both cases the Spanish panels showed significantly higher percentages of positive replies (around 80%). The question on the need to conduct further common activities for climate protection turned out to differentiate insufficiently (95% of all panelists agreed on its importance). However, the question on barrier-removing effects was taken up again in a more concrete, personal form in the third survey at the end of the participation processes. It asked panelists to assess whether "the joint efforts of the climate initiative have helped (you) to overcome personal barriers to climate-

[8] *Rho* Spearman's rank correlation coefficients; $p<0.01$.

friendly behavior." The extent of positive replies to the question on the participants' own experience was much lower than those received in the previous survey on assessing the general potential to alleviate barriers for individuals: On average 46 % strongly agreed or rather agreed, again to a significantly higher extent in Pamplona (56.5 %) and Saragossa (66.4 %). Nevertheless, this assessment of the community's contribution to reducing barriers on a personal level, after up to two years of collective initiative experience, suggests that it did help to remove barriers to some extent but also clearly shows its limits. We now proceed to inspect the correlation between the community effects described and the behavioral change index (Table 10.11).

The results confirm a positive relationship between behavior change and the three specific community effects for practically all countries involved; some correlations are highly significant. This holds especially for the direct relationship between a contribution in the form of the removal of personal barriers and behavioral changes. In addition, the stimulation of personal effort through the common initiative goes hand in hand with behavioral change, as indicated by the high correlation figure for Austria and the positive though weaker relationships for the two other countries. This finding is noticeable insofar as the small sample size was unlikely to yield significant values. Finally, we also see a positive relationship for the third variable for both Austria (0.31) and Germany (0.21) but not for Spain: Panelists who attach much importance to conducting further community activities for climate protection such as the one experienced show a higher extent of behavioral changes. In sum, this pattern among the findings lends empirical support to the hypothesized positive contribution of community-related effects to pro-climate behavioral change.

10.5 Conclusions

This chapter analyzed the extent to which a particular participation design around citizen panels in the e2d project led to increased awareness of climate-relevant consequences of everyday practices and changed attitudes as well as behaviors so as to support climate protection through low-carbon lifestyles. Seven similarly organized citizen panels in Austria, Germany, and Spain, collaborating over up to 2 years with governments at local level on the target to reduce CO_{2e} emissions by at least 2 % per year, were the centerpieces of collective local initiatives. One common core element was the regular monitoring of individual consumption activities by the panelists and feedback of information on CO_{2e} impacts for each of the five everyday activity categories, which allowed a comparison of the outcomes over time as well as with the panel and the national average. Two further core elements were access to various forms of information supporting steps towards CO_{2e} reduction and the provision of issue-specific local events, meetings, and other opportunities for exchange.

For all these participation activities, panelists could either use traditional media and face-to-face contacts or e-participation. Based on the relevant literature we expected that the unique combination of continuous individual CO_{2e} monitoring with information feedback and community engagement over a sufficiently long pe-

riod would have positive impacts on promoting both climate-relevant attitudes and behavior. The main results from three waves of surveys among the seven citizen panels (at the beginning, middle, and end of the processes) can be summarized as follows:

The empirical analysis shows that pro-climate awareness, attitude, and behavior changes have taken place during the participation processes in all panels although to different degrees. While a high increase of climate awareness and pro-climate attitudes was observable and could be attributed to the participation exercises, changes of behavior did not occur to the same extent. This is partly explained by behavioral changes that already took place before the participation exercises (e.g., in the field of water consumption), partly by the difficulties of changing social practices (e.g., nutritional habits) and local context conditions (e.g., transport options). However, in view of these constraints, an overall change of climate-relevant behavior of about 20% of the change potential on average as measured by the total change index is definitely noteworthy. The pattern of behavior changes largely confirms the existing literature and the "low-cost hypothesis" in particular. While differences in the behavioral changes tend to be related to context conditions in each region, regional differences in attitude changes are more related to panel characteristics at the start of the processes and characteristics of the local processes themselves. For example, the significantly higher attitude change among the panelists in Spain is made plausible by the comparatively lower profile of knowledge and interest in climate change at the start than in all other regions, whereas the characteristics of the panel in Bregenz displayed the opposite pattern.

In almost each region the results showed a relatively strong positive link between attitude and behavior change; however, they also indicated that attitude changes are not the only factor for behavioral changes and attitude change does not necessarily translate into behavioral change to the same extent. Since the changes observed rest on specific assumptions on causal mechanisms and mediating factors, the empirical analysis was also intended to shed light on the role of these. One part concerns the role of individual information feedback effects ("gentle nudge"), another one relates to collective social action aspects (community and social learning effects); the participation exercises rested on a combination of both. Moderate "gentle nudge"-type effects of the participation processes on behavior changes were confirmed for all three countries, although to a lower degree in Austria. In regard to the contribution of community factors, the majority of the panelists reported a community feeling and a substantial increase over time; nevertheless, the data do not substantiate a direct effect of community experience on behavioral change. However, a number of community-related factors were positively related to behavioral change, such as common issue learning, deliberation, exchange of experience, particularly on the topic of CO_{2e} footprints and good practice as well as the personal experience of effort enhancement and the removal of barriers through community support.

The fact that the participation processes lasted up to 2 years and that all seven exercises had identical contents and were similarly organized provide a firm basis for the comparative analysis. The empirical evidence based on longitudinal evaluation leads us to the conclusion that attempts to change individual behavior towards pro-

climate lifestyles through individual information feedback are more effective when they are embedded in a collective process such as joint local initiatives as participatory exercises. However, much depends on the regional and local implementation of the process, the participants' motivational profile, their abilities, and the support and change options available to them on their way from "carbon capability" (cf. Whitmarsh et al. 2011) to a carbon neutral society.

References

Aichholzer G, Cimander R, Kubicek H (2013) Can information save energy? A three country comparison of words and actions in participatory local climate protection projects. Int J Electron Gov 6(1):66–85

Blake J (1999) Overcoming the 'value-action gap' in environmental policy: tensions between national policy and local experience. Local Environ Int J Justice Sustain 4(3):257–278

Diekmann A, Preisendörfer P (1992) Persönliches Umweltverhalten. Diskrepanzen zwischen Anspruch und Wirklichkeit. Kölner Z Soziol Sozialpsychologie 44(2):226–251

Fischer C (2008) Feedback on household electricity consumption: a tool for saving energy? Energy Effic 1(1):79–104

Grunwald A (2010) Wider die Privatisierung der Nachhaltigkeit. Warum ökologisch korrekter Konsum die Umwelt nicht retten kann. GAIA 19(3):178–182

Gudowsky N, Bechtold U (2013) The role of information in public participation. J Public Deliberation 9(1):Article 3

Heiskanen E, Johnson M, Robinson M, Vadovics E, Saastamoinen M (2010) Low-carbon communities as a context for individual behavioural change. Energy Policy 38(12):7586–7595

IPCC (Intergovernmental Panel on Climate Change) (2007) Climate Change 2007: Synthesis Report. IPCC Secretariat, World Meteorological Organization, Geneva

IRGC (International Risk Governance Council) (2013) The rebound effect: implications of consumer behaviour for robust energy policies. A review of the literature on the rebound effect in energy efficiency and report from expert workshops. Lausanne, Switzerland

Krosnick JA (2002) The challenges of political psychology. Lessons to be learned from research on attitude perception. In: Kuklinski J (ed) Thinking about political psychology. Cambridge University Press, Cambridge, pp. 115–152

Peters M, Fudge S, Jackson T (eds) (2010) Low carbon communities. Imaginative approaches to combating climate change locally. Edward Elgar, Cheltenham

Rasul I, Hollywood D (2012) Behavior change and energy use: is a 'nudge' enough? Carbon Manage 3(4):349–351

Santarius T (2014) Der Rebound-Effekt: ein blinder Fleck der sozial-ökologischen Gesellschaftstransformation. GAIA 23(2):109–117

Shove E (2010) Beyond the ABC: climate change policy and theories of social change. Environ Planning A 42(6):1273–1285

Steg L, Vlek C (2009) Encouraging pro-environmental behaviour: an integrative review and research agenda. J Environ Psychol 29:309–317

Thaler RH, Sunstein CR (2008) Nudge—improving decisions about health, wealth, and happiness. Yale University Press, New Haven

Warde A, Southerton D (2012) Introduction. In: Warde A, Southerton D (eds) The habits of consumption, COLLeGIUM: studies across disciplines in the humanities and social sciences, vol. 12. Helsinki Collegium for Advanced Studies, Helsinki, pp 1–25

Whitmarsh L, Seyfang G, O'Neill S (2011) Public engagement with carbon and climate change: to what extent is the public 'carbon capable'? Global Environ Change 21(1):56–65