



Report No ECHOES 4.1 – D4.1 Meta-Analyses

# ECHOES Report

Identity Processes and individual factors in Energy Decisions – Two comprehensive Meta-Analyses



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## Identity processes and individual factors in Energy Decisions: Two comprehensive Meta-Analyses

### KEYWORDS:

- Energy saving behaviours
- Pro-environmental behaviours
- Identity
- Collective processes
- Emotions
- Attitudes
- Values

### VERSION

02

### DATE

22.12.2017

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### Quality insurance:

Biresselioglu, Mehmet Efe (IUE), Schwarzinger, Stephan (JR)

### PROJECT NO.

727470 (H2020)

### NUMBER of PAGES/APPENDICES:

84/0

### ABSTRACT

Disciplines like psychology, sociology and economics have extensively studied the mechanisms driving human energy choices. However, a knowledge gap still persists on the real links between psychological factors identified in earlier studies and people's observed and actual behaviours in the energy domain. In this report, we present the results of two meta-analyses (MA) that assessed, respectively, the link between identity factors and pro-environmental behaviours in general (Meta-analysis #1, N = 58.207; K = 125) and the links between individual levels factors and energy-saving behaviours (Meta-analysis #2; N = 59.948; K = 102). Based on a systematic review of published studies we estimated average effects size of predictor-criterion relations, publication bias, and relevant moderators for both MAs. Results of MA #1 reveal a robust positive link between environmental identity and connectedness to nature on the one hand and pro-environmental behaviours and intentions on the other hand, as well as a moderate relation of place identity to pro-environmental behaviour but not with pro-environmental intentions. Results of MA #2 reveal a consistent pattern of significant positive associations between individual-level psychological determinants (i.e., attitudes, intentions, values, awareness and emotions) and energy-saving behaviours. Moderation analysis revealed, however, that attitudes are significantly related to self-reported energy-saving behaviour and intentions, but unrelated to actual energy-saving behaviours.

### REPORT NO.

D4.1

### ISBN

NA

### CLASSIFICATION

Public

### CLASSIFICATION THIS PAGE

public

## Document history

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VERSION	DATE	VERSION DESCRIPTION
1	12.12.2017	First version for internal quality check
2	22.12.2017	Final version delivered to the European Commission

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## EXTENDED SUMMARY

Environmental global changes, such as climate change, global warming, biodiversity loss, or the depletion of natural resources have increasingly been in the focus of the scientific, political, economic and social world over the last three decades. Understanding the impact of human action and lifestyles upon the quality of our living environments, and of the natural resources therein, is therefore a crucial challenge for present times. The individual and social determinants of environmentally friendly human actions are currently in the focus of environmental and social psychological investigation, in various behavioural domains, including energy-related choices. Although disciplines like psychology, sociology and economics have extensively studied the mechanisms driving human energy choices still, there is a gap between psychological factors identified in earlier studies and people's observed and actual behaviours in the energy domain. Preliminary knowledge and literature reviews conducted in the earlier phases of ECHOES would suggest that this gap could be explained by psychological factors at two levels: a) individual level predictors; b) group membership and social identity processes. Thus, a major task of WP4 has been that of conducting a meta-analysis to identify the major individual, social and environmental psychological mechanisms involved in sustainable energy use.

**Because of the complexity and extension of the scientific literature in this field, we decided to split the meta-analysis in two different meta-analytical corpora:**

- A meta-analysis focused on the link between identity factors (namely, social and environmental identity, connectedness to nature, place identity and attachment) and environmentally-relevant behaviours (including, but not limited to, energy-related behaviours);
- A meta-analysis focused on the link between individual-level factors (attitudes, intentions, values, awareness, emotions) and energy-saving behaviours.

### **Meta-analysis on social and personal identity variables predicting pro-environmental action**

Identity processes are increasingly recognized as potential drivers of pro-environmental action. This is true for different types of identity variables, such as social identity, environmental identity, connectedness to nature, and place identity. As social and personal identity effects on pro-environmental action have different implications for implementing pro-environmental policies, we were particularly interested in comparing the relative impact of these different kinds of identities.

To evaluate the policy potential of identity processes, one needs to look at the totality of available evidence, rather than on single experiments or surveys. While narrative reviews on some of the relevant predictors have been published recently (Restall & Conrad, 2015; Fielding & Hornsey, 2016; Fritzsche, Barth, Jugert, Masson & Reese, in press), a quantitative review of the literature has not been available up until now. The task of the present work is, therefore, to systematically evaluate existing research on the links between pro-environmental behaviours and behavioural intentions and different types of personal and social identity. We focus, specifically, on social identity, environmental identity, connectedness to nature, place identity and on their links to pro-environmental behaviours and intentions.

We conduct a series of eight meta-analyses, drawing on data from 125 independent samples with 58,207 participants. Using quantitative meta-analytical methods, we conclude that most of the studied associations between identity variables and outcome variables are positive and moderate in size.

The evidence, specifically, points to a robust positive role of environmental identity (seeing yourself as an environmentally conscious person) and connectedness to nature (feeling yourself being connected to nature as a larger system) in promoting pro-environmental behaviours and intentions. Connectedness to nature is more strongly related to pro-environmental behaviours in female participants and in samples from individualistic countries (e.g., The United States, United Kingdom and The Netherlands), whereas the relations are weaker for males and less individualistic countries.

The evidence also suggests that forming a pro-environmental social identity (constructing yourself as a person that belongs to a social group which is environmentally conscious) might potentially be the most powerful driver of a general propensity for pro-environmental action. Pro-environmental social identities might motivate behaviour both directly and also by making adherence to pro-environmental social norms more attractive to high identifiers (Fritzsche et al., 2017). However, it would be premature to draw definitive conclusions with regards to pro-environmental social identity, as there have been only eight primary studies focusing on this variable so far.

The results with respect to the effects of place identity (or place attachment) are mixed. Place identity (the feeling of belongingness to a physical space such as a city or region) is a moderately strong predictor of behaviour but it does not appear to be linked to pro-environmental intentions. Interestingly, place identity has a more pronounced influence on younger people. However, the mixed results may – partly – stem from differences in the measurement of place identity.

One limitation of this work is that we were able to locate only a couple of studies on energy consumption, electric mobility and smart energy technology. Replications focusing on these important areas are therefore needed. The broad scope of our literature search, nevertheless, suggests that our results are very likely generalizable to these specific behavioural domains.

In sum, our findings confirm the substantial policy potential of all studied identity variables (with some mixed results observed in case of place identity). If policy can contribute to either forming or triggering the social identities, likelihood of pro-environmental behaviour across different domains will increase. The next two steps to realizing the full potential of identity processes consist of conducting smaller-scale laboratory experiments, followed by scaled-up field experiments. These experiments need to firmly establish the causality of the proposed relationships and to delineate the contextual conditions (i.e. boundary conditions) under which identity variables will lead to the most favourable environmental outcomes.

### **Meta-analysis on individual level psychological factors and energy saving behaviour**

Individual level factors such as ecological attitudes, pro-environmental values, awareness of consequences of one's behaviour, beliefs in climate change, emotions intended as motivational drivers of human behaviour, and intentions to adopt energy saving solutions have been frequently considered as potential antecedents of energy saving behaviour (ESB).

Also in the case of the individual-level factors at the basis of the transition towards more sustainable energy consumption and renewable energy sources, a systematic review of the literature considering all of these factors has not been conducted up until now. Thus, the main task of the current work was to systematically evaluate existing solid empirical evidence on the links between all of these factors (i.e., ecological attitudes, pro-environmental values, awareness of consequences, beliefs in climate change, emotions, and intentions to adopt energy saving solutions) and ESB. In particular, the intention to adopt energy saving solutions has been considered both as predictor of self-reported and actual ESB or as an outcome, when self-reported and actual behaviour were not available in the primary studies considered. A number of studies use the measure of intention only as an outcome of antecedent factors aimed to explain the adoption of energy saving solutions but, in doing so, it is not clear whether individuals' intention can be considered as a real proxy of behaviour in the energy domain or it is only integrating the more proximal antecedents of ESB. The scientific understanding of this crux is relevant to tailor policy campaigns and interventions because, on the one hand, it makes clearer that the intention might be considered as a factor somewhat different from individuals' behaviour. On the other hand, it identifies the intention as a relevant leverage to be used in advertisement and policy campaigns to foster the adoption of energy saving solutions.

We conduct a comprehensive series of five meta-analyses, drawing on data from 102 independent samples with 59,948 participants. Using a meta-analytical approach, we conclude that most of the studied associations between individual-level factors and energy-saving outcome variables are positive and moderate in size, ranging from small-moderate effects for pro-environmental values to large effects for emotions.

The results of the current meta-analysis specifically points out a robust positive role of emotional processes (such as anticipated pride when reaching the goal to save energy), considered as motivational drivers, in relation to energy saving behaviour. More interestingly, the relationship between this factor and energy saving behaviour would seem to vary as a function of gender and age. In particular, such a relationship would seem to be stronger among men than women (which also contrasts with the effects found for identity in the first section of this report). This implies that men can be more successfully addressed by behaviour-specific emotional factors, whereas women seem more receptive for the overarching social identity focus. Furthermore, the link between pro-environmental value and ESB varies as a function of age, being stronger among younger people.

The relationship between attitude and ESB revealed interesting results, in particular when considering the different ways through which ESBs have been operationalized as an outcome. In particular, the relationship between attitude and behaviour is not statistically significant when actual behaviour is considered as outcome (e.g., actual electricity consume measured in kWh). Moreover, a statistically significant difference emerged between the effects sizes linking attitudes to either energy-saving behavioural intentions or energy-saving self-reported behaviour, respectively: the effect size for the attitude-intention link is large, while the effect size for the attitude-behaviour link is moderate. Based on these results, policy makers and all actors involved in the transition towards sustainable energy sources should keep in mind these differences when tailoring policies, interventions or campaigns fostering such a transition in the society at large. In fact, changing attitudes is not enough to change actual behaviour, since the links between attitudes, intentions and behaviour in the energy saving domain (especially actual behaviour) are not always that strong.

In sum, the results of the current meta-analysis confirm the substantial associations between the individual-level factors investigated and ESB. In particular, our moderation analyses show further relevant factors that need to be taken into account when researchers investigate this phenomenon or policy makers tailor policies and campaigns aimed to foster a transition towards more sustainable energy sources in the society at large.

**Therefore, based on the results of the two studies, we recommend the following policy focus:**

- Collective or social identities can be powerful drivers of pro-environmental action intentions when people associate them with pro-environmental values and goals in their everyday life. Thus, policies that highlight the distinct collective nature of sustainable energy projects could be an effective way to promote transitions to more sustainable energy use in people's daily life decisions. This may be fostered on both the level of face-to-face groups and with regard to broader social categories. That means, for instance, incentivizing local communities, neighbourhoods or private associations to engage in collaborate energy action. At the same time the transition to sustainable energy supply should be framed as a collective challenge on the country or EU level. This should be even more effective if collective projects can be defined that are specific for the respective collective (e.g., the nuclear phase-out in Germany) or that create intergroup competition (who is winning the race to the age of renewable energy, the EU, the US, or China?).
- Strengthening personal connections to nature and pro-environmental beliefs should be a focus of educational policies, as it has broad-range effects on people's receptiveness concerning pro-environmental behaviour changes. For instance, this might be attained via contents of formal education, such as addressing ecological topics and valuing nature at school. Also, for specifically fostering the mental connection between nature and people's self (i.e., identity), it seems advisable to create opportunities of people discovering a special connection they have to nature and to preserving nature. As personal routes to a personal pro-environmental identity should vary to a considerable degree, affecting collective identities might be the most efficient policy strategy (see below).

- Emotions and affective factors (such as pride for reaching “save energy” goals) can be a relevant motivational driver of energy saving behaviour. The role of emotions in energy saving might be particularly relevant for specific social groups (for instance among men, compared to woman), while the link between identity and pro-environmental behaviour seems to be stronger among women than men. This would imply that men might be more successfully addressed by campaigns or policies that make use of behaviour-specific emotional arguments, while women might be more effectively reached through campaigns or policies based on an overarching social identity focus. Likewise, the link between pro-environmental values and energy saving behaviour seems stronger among younger people, and this would suggest that value-driven appeals could be particularly affective in policies and campaigns targeting younger generations.
- The relations between attitudes, intentions and actual energy saving behaviour is less strong than one might expect, and it is still not completely clear whether individuals’ intention to save energy can be considered as a real proxy of behaviour in the energy domain. The scientific understanding of this crux might be relevant to tailor policy campaigns and interventions because. Indeed, it should be made clear that intentions might be considered as a different factor from individuals’ actual behaviour. Therefore, persuasive campaigns or policy interventions that only target intentions as a relevant leverage to foster the adoption of energy saving solutions might run the risk of being ineffective.



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# 1 GENERAL INTRODUCTION AND OVERVIEW

Environmental global changes, such as climate change, global warming, biodiversity loss, or the depletion of natural resources have increasingly been in the focus of the scientific, political, economic and social world over the last three decades. Understanding the impact of human action and lifestyles upon the quality of our living environments, and of the natural resources therein, is therefore a crucial challenge for present times. From a social and behavioural sciences point of a view, a fundamental step into this direction can be done through the systematic investigations of the factors that drive human behaviour and choices in relation to the environment, and the various psychological mechanisms involved at different levels of social and cognitive processes. For these reasons, the individual and social determinants of environmentally friendly human actions are currently in the focus of environmental and social psychological investigation, in various behavioural domains, including energy-related choices. Although disciplines like psychology, sociology and economics have studied extensively the mechanisms driving human behaviours and choices related to sustainable energy transition, attempts to exploit this research for boosting the efficacy of energy policies largely failed. As put forward in the description of work to be done within the ECHOES project, there is a gap between predicted decisions based on factors for driving individual decision making as identified in earlier studies, and people's observed and actual decisions in the energy domain. Preliminary knowledge and literature reviews conducted in the earlier phases of ECHOES suggest that this gap could be explained by psychological factors at two levels: on the one hand, we can certainly underline the role of individual level predictors of pro-environmental and energy-related human behaviours, which have been in the focus of classical investigations on human decision making basing on rational choice theories and expectancy-value models, such as attitudes, intentions, values, awareness, and emotions. On the other hand, we can point to the role of the group membership and social identity processes as driving factors impacting actual decision making in the environmental and energy-related domain. Coherent with this assumption, WP4 of the ECHOES project, to which the present report pertains, aims at understanding how energy related decision making works on individual level, and how groups and collective factors might impact these decisions. Thus, a major task of WP4 has been to conduct a quantitative re-analysis of published studies in a meta-analytical framework to identify the major individual, social and environmental psychological mechanisms involved in sustainable energy use.

Because of the complexity and extension of the scientific literature in this field (to many extents wider and deeper than what we initially previewed within the ECHOES consortium when writing the project proposal), and for practical reasons related to the selection, coding, data extrapolation and statistical calculation involved in meta-analytical studies on human behaviour, we decided to split the meta-analysis foreseen within WP4 in two different meta-analytical *corpora*:

1. A meta-analysis focused on the link between a relatively circumscribed set of predictors related to social identity theory (namely, social and environmental identity, connectedness to nature, place identity and attachment) and a wider set of environmentally-relevant behaviours (including, but not limited to, energy-related behaviours);
2. A meta-analysis focused on the link between a relatively larger set of predictors related to individual-level drivers of human decisions (attitudes, intentions, values, awareness, emotions) and a more circumscribed set of energy-saving choices and behaviours.

Meta-analysis is gaining increasing popularity as a major tool for providing robust synthesis of available empirical evidence over a broad range of domains and disciplines within social, behavioural and medical sciences. Before presenting more in detail the full results of our meta-analytical work, it is important to recall here some basic features regarding meta-analysis as a general methodological approach.

### Features of Meta-Analyses:

- Meta-analysis is a statistical method to jointly analyse the strength of effect sizes of a large number of empirical studies. Thus, it provides a better estimation of the real effect size than each individual study.
- Meta-analyses take into account the sample size of each study and heterogeneity of studies when pooling the data to make the results robust against peculiarities that characterize single studies.
- Since the scientific publication process favours publication of results that pass the statistical significance criterion, there is a certain danger of overestimating the effect sizes in meta-analyses (publication bias). This aspect is analysed in the process by inspecting the so-called “funnel plots” (see figures in Chapters 2 and 3), to estimate how big this publication bias is.
- A meta-analytical approach also offers the possibility to test if effect sizes (e.g., the relation between two variables of interest) vary across systematic variations in the conducted primary studies (e.g., the cultural context they are conducted in, or the sample typologies, etc.). We made use of this possibility in both the meta-analyses reported below.
- The most demanding step of a meta-analysis is locating the relevant primary studies and getting access to their data-sets (which are not always published in the form that is needed). For both our analyses, we used the comprehensive literature study conducted for the ECHOES literature review<sup>1</sup> as a starting base to identify relevant studies.
- While a meta-analysis is a powerful method to eliminate biases of single studies, its usefulness depends strongly in the number of studies that are pooled. In areas where only few studies are published, a meta-analysis provides more insecure results than in areas where the body of published studies is large.
- The quality of a meta-analysis depends also on the comparability of the measures for the same construct analysed across the different primary studies identified and selected.

In the remaining sections of this deliverable we will report more in detail the background theoretical rationale, the main literature findings, the methods followed and the major results obtained for each of these two meta-analytical endeavours, and we will briefly discuss the implications of the results for the overall ECHOES project and for the more general issue of sustainable energy transitions.

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<sup>1</sup> [https://www.echoes-project.eu/sites/echoes.drupal.pulsartecnalia.com/files/ECHOES\\_D3.1\\_literature\\_report\\_1.pdf](https://www.echoes-project.eu/sites/echoes.drupal.pulsartecnalia.com/files/ECHOES_D3.1_literature_report_1.pdf)

## 2 IDENTITY AND PRO-ENVIRONMENTAL BEHAVIOUR: A META-ANALYSIS

### 2.1 Summary of meta-analysis #1

In our first meta-analysis, we conduct a series of eight separate meta-analyses, based on 125 independent samples with 58,207 participants, to evaluate the strength of the associations between different types of identity on the one hand, and pro-environmental behaviours and behavioural intentions on the other. The results show that connectedness to nature and social identity are moderately strongly associated with pro-environmental behaviour and behavioural intentions. The link between pro-environmental social identity and the dependent measures is medium-to-large, but this result is based on few observations only. The association between environmental identity and pro-environmental behaviours/intentions is medium-to-large. There is no link between place identity and intention, but there is a moderately strong positive link between place identity and pro-environmental behaviour. The links between the identity measures and pro-environmental behaviours/intentions tend to be weaker in samples with older participants. The associations between social identity and behaviour and between connectedness to nature and behaviour are stronger for women. Connectedness to nature has a slightly stronger influence on behaviour in more individualistic countries.

### 2.2 Introduction to meta-analysis #1

Identity processes are increasingly recognized as potential drivers of pro-environmental action. This is true for different types of identity variables, such as social identity (Masson & Fritzsche, 2014), environmental identity (van der Werff & Steg, 2016), connectedness to nature (Mayer & Frantz, 2004; Tam, 2013) and place identity (Vaske & Kobrin, 2001). While narrative reviews on connectedness to nature (Restall & Conrad, 2015) and on social identity processes in the environmental domain (Fielding & Hornsey, 2016; Fritzsche et al., in press) have been published recently, a quantitative (and more systematic) review of the relevant literature has not been available until now.

To evaluate the policy potential of identity processes, one is well-advised to look at the totality of available evidence, rather than on single experiments or surveys (cf. Maniadis et al., 2014). Thus, one task of the present report is to systematically evaluate existing research on the links between pro-environmental behaviours and behavioural intentions and different types of personal and social identity. A meta-analysis is well suited for this purpose, as it aggregates results from multiple studies and thus gives an accurate estimate of the average (i.e. “true”) effect size. A good understanding of what a typical effect size might be is important from an applied perspective, as this makes it possible to implement interventions that are effective and efficient because the relation between the behavioural outcome and the driver variable is strong.

In the remainder of this section, we turn to the identity variables that are the focus of this work. We present the theoretical background for the analyses to follow. In Section 2.3 we outline the methods we employ. In Section 2.4 we present our findings, which we subsequently discuss in Section 2.5. Section 2.6 concludes with a summary of our central findings.

#### 2.2.1 Social identity

Most existing approaches conceive of individuals' pro-environmental action as the result of personal or inter-personal decision-making (e.g., Bamberg & Möser, 2005). For instance, much research is using a theory of planned behaviour framework (Ajzen & Fishbein, 2005), including attitudes, subjective norms, and perceived behavioural control as predictors of people's pro-environmental action (e.g., switching to green power, using electric car-sharing, protesting against coal-mining). Here, attitudes represent personal cost-benefit analyses, determined by the beliefs about which consequences a specific behaviour may have (e.g., saving money, providing fun, involving personal health risk) and the subjective value individuals assign to each of these consequences. Subjective norms are the anticipated evaluations by other significant persons (e.g., my partner, my mother, my boss, my friend) in case the individual would perform the respective behaviour and her or his willingness to comply with these people. Perceived

behavioural control looks at whether individuals think they are personally able to perform the behaviour (e.g., managing to operate an electric vehicle, finding a well-insulated flat to rent, reading a smart meter device). Also related to issues of control, and thus, to whether or not people are motivated to implement sustainable energy behaviours, is the question of outcome control. This is people's belief that they will be able to impose certain outcomes through their own action, for instance, reducing climate change or inner-city air pollution. It is known, that it has a strong de-motivating effect when people doubt their efficacy to make a difference in the world. For instance, this should be the case when rational actors realize that their personal impact on large-scale, and often global, environmental crises (e.g., global climate change) is of invisibly low magnitude or virtually non-existent .

This is one reason why models that assume pro-environmental action to be – solely – an individuals' personal decision might be basically flawed. If people would base their pro-environmental decisions just on personal costs, benefits, and efficacy, almost all of them would decide against green action. This is not just because of personal helplessness in face of global crises but also due to individual rationality. From the perspective of behavioural economics, pro-environmental action violates individual rationality as here, individual actors are part of a social resource dilemma structure. The so-called "tragedy of the commons" (Hardin, 1968) implies that individuals who contribute to the preservation of a publicly accessible resource that regenerates at low level act irrational, because they forgo individual benefits although other, individually rational, actors may exploit the resource to maximum degree.

Nevertheless, people often intend to act, and actually act, in a pro-environmental manner, for example by reducing their personal energy consumption. Recent theorizing and an emerging research literature (Fritzsche et al., in press) suggests that this becomes possible through a process of social identity that has been somewhat overlooked in earlier environmental psychology research. People have the, perhaps unique, capacity to define their self in terms of "We" instead of "I". That is, according to the social identity approach (Reicher, Spears & Haslam, 2010; Tajfel & Turner, 1979; Turner, Hogg, Oaks, Reicher & Wetherell, 1987), in many situations people perceive, think, feel, and act as representatives of collectives instead of their individual person. Which collective defines the self is determined by both people's sense of chronic affiliation to certain groups (e.g., their nation, gender, or political party) as well as situations in which a certain ingroup gets into people's focal attention, such as when people compare their own group with another (e.g., during international climate negotiations, football matches, intergroup conflict, etc.; van Zomeren, Postmes & Spears, 2008) or when they learn about shared goals and opinions through communication (e.g., Thomas, McGarty & Mavor, 2016). When people identify with a group, they see the world from the perspective of their ingroup and adopt collective beliefs and intentions as their own through a process of self-stereotyping (i.e., adopting the stereotype about one's own group as a description of the self; Hogg & Turner, 1987). This psychological process should be of high importance for motivating people's pro-environmental action and decisions.

Collectives (of people) are the appropriate agents to tackle collective problems, such as large-scale environmental crises, as addressing these problems is only promising on a collective level. Also, recognizing shared social identity has been shown to increase cooperation in social dilemma situations (DeCremer & van Vugt, 1999; Kramer & Brewer, 1986), indicating that social identity replaces personal with collective rationality. Emerging from an extensive review on social identity effects on environmental appraisals and responses, parts of it done within ECHOES, we recently proposed a Social Identity Model of Pro-Environmental Action (SIMPEA; Fritzsche et al., in press). This model departs from previous models of social-identity based collective action (Thomas, Mavor, & McGarty, 2011; van Zomeren et al., 2008). SIMPEA proposes that the degree to which people identify with groups and to which they consider these groups to be collectively efficacious and characterized by pro-environmental norms determines both their appraisals of and responses to environmental crises. With regard to appraisals, for instance, affiliation with political groups who consider climate change an important threat will lead to respective threat appraisals whereas, identified members of groups who see human-made climate change as an invention of some evil elites would consider it either harmless or at least outside human responsibility. Regarding pro-environmental responses, ingroup identification as such is assumed to foster people's sustainability efforts when they perceive green ingroup norms, which might be genuinely the case for environmental action groups but may also occur among groups who are not intrinsically associated with environmental action, such as city dwellers,

occupational groups, or EU citizens. Here, situated perceptions of pro-environmental ingroup norms should be necessary to motivate environmental action in highly identified members. For instance, Masson and Fritsche (2014) showed that high identification with German university students who learned that a vast majority of university students would purchase organic food on a regular basis and appreciated organic food consumption positively predicted students' intentions to buy organic in the future. No such effect occurred for students who were told that only a minority of students would regularly choose organic food and appreciate organic shopping. There are also first indications that perceived collective efficacy increases highly identified group members' pro-environmental intentions (e.g., switching to sustainable mobility). Supporting the notion of self-stereotyping, Jugert et al. (2016) found that this effect was driven by improving people's perceptions that they personally could bring about significant changes in the state of the natural environment.

Focusing on social identity as a driver of people's individual pro-environmental action (Fielding & Hornsey, 2016; Fritsche et al., in press; Postmes, Rabinovich, Morton, & van Zomeren, 2014) complements traditional models of personal decision-making, such as the approaches described above (e.g., Bamberg & Möser, 2005; Klöckner, 2013). It is not just that social identity may determine people's personal calculus variables, such as personal attitudes or personal self-efficacy (Jugert et al., 2016). Also, identification with efficacious and pro-environmental social ingroups is expected to predict individuals' environmental action intentions in a direct way, over and above possible person-level predictors. A recent study on people's intention to use electric vehicles provides first evidence for this (Barth, Jugert & Fritsche, 2016). Specifically, beyond personal costs (e.g., low range, high purchasing costs) and benefits (e.g., low maintenance costs) as well as the perception of e-cars' environmental friendliness, perceived ingroup norms and a sense of collective efficacy in making the switch to sustainable mobility, predicted people's intention to use an electric vehicle in the future. Of importance, both lay persons and environmental experts seem to dramatically underestimate the impact of social identity variables on people's pro-environmental decisions.

In the present study, we address the impact of social identity on pro-environmental action intentions in a quantitative meta-analysis, for the first time. Although the present inquiry focuses on energy behaviour, we included studies on other domains of pro-environmental action as well. This is due to the fact that, as an emerging field, we anticipated the number of social identity studies on energy behaviour to be rather low. However, as sustainable energy use is usually part of what people consider as pro-environmental behaviour, results on pro-environmental action should help to gauge the impact social identity has on energy behaviour.

To precisely assess the contribution of social identity, we will try to distinguish it from other – personal - identity concepts and their impact on pro-environmental action. In the past, research on individual identity predictors has been thriving in parallel to traditional models of environmental decisions. Such identity models focus on the general notion that individuals' actions are strongly affected by whom they think they are as a person (and not just by personal beliefs and attitudes). We will introduce three environment-related identity concepts (environmental identity, connectedness to nature, place identity) in the following sections.

## **2.2.2 Environmental identity**

It is often necessary to demonstrate that a new predictor can explain additional variance in an outcome variable that is not accounted for by already established theories, before it is given serious consideration in the research community (Ajzen, 1991). An important step towards introducing environmental identity into environmental psychology was thus made by Sparks & Shepherd (1992) who demonstrated that one's identity as a green consumer can predict pro-environmental intentions (namely intention to consume organic vegetables) over and above variables included in Ajzen's (1985) theory of planned behaviour (see also Terry et al., 1999; Whitmarsh & O'Neill, 2010; Dean et al., 2012; Gatersleben et al., 2014; Lokhorst et al., 2014; Lois et al., 2015).

Since the seminal study by Sparks & Shepherd (1992), environmental identity research has been gaining momentum, with the development of new measurement scales (Clayton, 2003; Whitmarsh & O'Neill, 2010; Walton & Jones, 2017) and promising theories in which environmental identity plays a central role (van der Werff et al., 2014b; van der Werff & Steg, 2016).



We are also beginning to understand in which specific domains environmental identity plays a particularly strong role. Whitmarsh & O'Neill (2010) show this to be the case in the behavioural domains of energy and water conservation (see also Lauren et al., 2016; Prati et al., 2017), recycling and waste reduction (see also Terry et al., 1999; Nigbur et al., 2010; Gatersleben et al., 2014; Lapinski et al., 2017), and buying eco-friendly products and services (see also Dean et al., 2012; Kashima et al., 2014; Barbarossa & De Pelsmacker, 2016). In addition, Kashima et al. (2014), Lacasse (2016) and Schuldt and Pearson (2016) show that environmental identity predicts support for sustainability policies. And, as a final example, Barbarossa et al. (2015) find a moderate to strong link between the intention to adopt an electric car and environmental identity using data from three different countries (Belgium, Denmark and Italy).

There are different variants of environmental identities, some of which are conceptually broad, while others are domain-specific. The domain- or behaviour-specific types include identities such as energy conserver identity (van der Werff et al., 2013b), water conserver identity (Lauren et al., 2016), recycler identity (Terry et al., 1999; Nigbur et al., 2010; White & Hyde, 2011; Lapinski et al., 2017) or environmental gardener identity (Kiesling & Manning, 2010).<sup>2</sup> The broader types of environmental identity attempt to capture one's self-perception as a pro-environmental consumer (Sparks & Shepherd, 1992; Dean et al., 2012; Gatersleben et al., 2014) or even more broadly as a pro-environmental person (van der Werff et al., 2013a, 2013b).<sup>3</sup>

What makes environmental identity a suitable focus of interventions designed to promote pro-environmental behaviour, including energy conservation and the adoption of new environmentally beneficial technologies, is the fact that identity appears to be malleable. Van der Werff et al. (2014b) show that one's environmental identity has both a relatively stable component shaped by one's values (see also van der Werff et al., 2013b; Gatersleben et al., 2014), and a more variable component that can be affected by prior pro-environmental actions (see also van der Werff et al., 2013a, 2014a; Lacasse, 2016; Truelove et al., 2016; Prati et al., 2017). The observation that one's perception of their own identity changes as a function of one's past behaviour is in line with extensive research in the cognitive dissonance (Festinger, 1957; Kantola et al., 1984; Thøgersen, 2004; Priolo et al., 2016) and self-perception traditions (Bem, 1972; Lee et al., 2016). More generally, though, this observation suggests that there can be other ways of strengthening and cultivating people's environmental identity. Furthermore, various other interventions designed to promote pro-environmental behaviour – for instance normative interventions (Schultz et al., 2007) or commitment-based interventions (Baca-Motes et al., 2013) – can presumably exert an indirect effect on environmental identity through increased pro-environmental behaviour, leading to a positive feedback loop between behaviour and identity.

In our meta-analysis, we only examine environmental identity's "additive" and "direct" effects on behaviour. That said, two things need to be pointed out. First, there is evidence that besides its direct effect, environmental identity also has indirect effects on behaviour, which operate through other variables, such as personal norms. I.e., environmental identity shapes personal norms, which in turn motivate behaviour (van der Werff et al., 2013a; Barbarossa et al., 2015; van der Werff & Steg, 2016). This can be of interest from an applied perspective because identity-based interventions can then be evaluated also with respect to their influence on mediator variables like personal norms. Second, environmental identity may interact with other variables, such as social norms (Lapinski et al., 2017; see also Yun & Silk, 2011), one's past behaviour (Dean et al., 2012), and behaviour visibility (Brick et al., 2017). This is important, because these personal-level and contextual moderators can boost (or sometimes dampen) the impact of identity-based interventions.

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<sup>2</sup> It might be discussed though, if behaviour-specific identities are a valuable construct, since they often are inseparably intertwined with other intrapersonal and contextual factors affecting these behaviours.

<sup>3</sup> Typical operationalizations of environmental identity employ items such as "I think of myself as an environmental person" (Lauren et al., 2016), "I am the type of person who acts environmentally friendly" (van der Werff et al., 2013a, 2013b, 2014; Lacasse, 2016), "I think of myself as a green consumer" (Sparks & Shepherd, 1992; Barbarossa et al., 2015; Barbarossa & De Pelsmacker, 2016), "I personally think of myself as a water conserver" (Lauren et al., 2016), "Saving energy is an important part of who I am" (van der Werff et al. 2013b), "To engage in household recycling is an important part of who I am" (White et al., 2011).



### 2.2.3 Connectedness to nature

In classifying different variables under the category of connectedness to nature, we have taken a liberal, inclusive approach. We are including a number of slightly different variables in our connectedness to nature category, such as inclusion of nature in the self (Schultz, 2001), connectedness to nature (Mayer & Frantz, 2004), nature relatedness (Nisbet et al., 2009), and commitment to nature (Davis et al., 2009).<sup>4</sup> What these variables have in common is that they measure the extent to which an individual feels connected to nature or feels nature to be a part of the self.<sup>5</sup>

While many of the included variables have specific characteristics that make them distinct (Schultz et al., 2004; Nisbet et al., 2009; Davis et al., 2011; Tam, 2013), there is evidence that they are substantially intercorrelated (Mayer & Frantz, 2004; Brügger et al., 2011; Davis et al., 2011; Tam, 2013; Martin & Czellar, 2016; but see Geng et al., 2015) and there are numerous similarities on the conceptual level as well.

Once there is more data available on the identity subtypes grouped together in our “connectedness to nature” category, one can conduct separate analyses for each of the subtypes, which would make it possible to identify the strongest predictors of environmental behaviour in this set of similar constructs (for initial comparisons of the predictive ability of these variables see Brügger et al., 2011; Davis et al., 2011; Tam, 2013).

Connectedness to nature has been implicated as a predictor of behaviour and behavioural intention in a number of domains, including environmentally friendly transportation (Beery & Wolf-Watz, 2014; Hedlund-de Witt et al. 2014), energy conservation and the use of renewable energy (Hedlund-de Witt et al. 2014; Sparks et al., 2014), and purchases of eco-friendly products (Haws et al. 2014; Hedlund-de Witt et al. 2014; Martin & Czellar, 2016). Connectedness to nature also predicts pro-environmental behaviour measured by general scales encompassing several domains (Mayer & Frantz, 2004; Nisbet et al., 2009; Brügger et al., 2011; Davis et al., 2011; Nisbet & Zelenski, 2013). Sometimes the link between connectedness to nature and pro-environmental behaviour is weak to negligible, however (see e.g. Beery & Wolf-Watz, 2014; Hedlund-de Witt et al. 2014).

Like environmental identity, connectedness to nature appears to be to some extent subject to outside influences, which is one of the conditions for being able to implement an effective intervention. Using samples of 9-13 year-old children, Liefänder et al. (2013) show that environmental education fosters connectedness to nature (for a related study among university students see Nisbet et al., 2011). Schultz and Tabanico (2007), Nisbet et al. (2009), Collado et al. (2013) and Tam (2013) show that the mere contact with nature is associated with increased connectedness to nature. In addition, Mayer et al. (2009) and Nisbet and Zelenski (2011) provide experimental evidence confirming that contact with nature increases nature connectedness.

For related experiments exploring the effects of technology-mediated experiences of nature on connectedness to nature see Mayer et al. (2009), Weinstein et al. (2009), Zelenski et al. (2015), Ahn et al. (2016) and Arendt and Matthes (2016). Perhaps unsurprisingly, technology-mediated nature (e.g., nature documentaries) seems to have a weaker impact on nature connectedness than real nature (Mayer et al., 2009; Arendt & Matthes, 2016).

There is reason to believe that interventions based on manipulating connectedness to nature or on making one's connectedness to nature salient would avoid negative side effects on the intervention's targets' emotional well-being. Such negative side effects sometimes occur, for instance, when people are under normative pressure to

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<sup>4</sup> Restall & Conrad (2015) even consider biospheric values or environmental worldviews to be measures by nature connectedness. However, this is not a common position in environmental psychology.

<sup>5</sup> Sample items include “I often feel a sense of oneness with the natural world around me” (Mayer & Frantz, 2004), “I feel a sense of oneness with nature” (Dutcher et al., 2007), “Feeling a connection with the environment is important to me” (Davis et al., 2009), “My relationship to nature is an important part of who I am” (Nisbet et al., 2009), “Whenever I spend time in nature nowadays I do not experience a close connection to it” (reversed, Kals et al., 1999).

behave pro-environmentally (Sussman & Gifford, 2012; Bergquist & Nilsson, 2016; Vesely & Klöckner, 2017). In contrast, connectedness to nature is linked to positive emotional experiences and well-being (Mayer & Frantz, 2004; Mayer et al., 2009; Howell et al., 2011; Nisbet & Zelenski, 2011; Nisbet et al., 2011; Tam, 2013; Martin & Czellar, 2016; for a meta-analysis see Capaldi et al., 2014). This could make connectedness-based interventions an attractive policy instrument.

## 2.2.4 Place attachment and place identity

People-place relationships have been studied in various social disciplines, including geography, sociology, anthropology, psychology and urban studies (Lewicka, 2011). Unsurprisingly, this has resulted in a diversity of theoretical and empirical approaches, applying different concepts and terms such as place attachment, place identity, community attachment, place dependence, or sense of place (Hidalgo & Hernández, 2001).<sup>6</sup> In the light of this diversity, Hidalgo and Hernández (2001) concluded that there is no agreement regarding the definition or the (proper) methodological approach to deal with place attachment. However, as a very basic definition they propose that place attachment refers to “an affective bond or link between people and specific places” (ibid., p. 274). Other authors have suggested similar definitions (Low, 1992; Shumaker & Taylor, 1983). Building on this definition, Hidalgo and Hernández (2010) distinguished between two dimensions of place attachment, physical and social attachment. Physical attachment describes attachment based on the physical component of place (e.g. physical residential environment) and a sense of rootedness predicted by, among others, length of residence and ownership (Scannell & Gifford, 2010a). Social attachment refers to attachment based on interpersonal, community and cultural relationships (e.g. in the neighbourhood). Ujan and Zakariya (2015) proposed a different (and less affective-toned) conception, distinguishing between place dependence (i.e., place provides resources or features that support specific goals or desires), place identity (i.e. place as basis for the development of self-identity), and sense of belonging and rootedness (i.e. sense of attachment to a specific place) as three dimensions of place attachment. For place identity, Proshansky, Fabian and Kaminoff (1983) defined the construct as a “sub-structure of the self-identity of the person consisting of, broadly conceived, cognitions about the physical world in which the individual lives” (ibid, p. 59). Such cognitions may contain attitudes, values, preferences and conceptions of behaviour, which relate to people’s physical surroundings. Adding to that diversity, some researchers have conceived of place attachment as a unitary construct (Low, 1992), whereas others have put forward a multidimensional notion of place attachment. This short review supports Lewicka’s (2011) conclusion that the relations between the various place-related concepts are unclear, limiting theoretical as well as empirical progress (Hidalgo & Hernández, 2001).

Recently, Scannell and Gifford (2010a) as well as Droseltis and Vignoles (2010) proposed two comprehensive models to describe people-place relationships, or place attachment more specifically. Following Scannell and Gifford’s tripartite organizing framework, place attachment can be divided into a person dimension, a psychological dimension, and a place dimension. The “person” dimension (“Who is attached?”) refers to the extent to which attachment is based on individually held meanings (e.g. from personally important experiences; Manzo, 2005) or collectively held meanings (e.g. attachment based on group membership or religious-based attachment). The “process” dimension describes the way people psychologically relate to a certain place. This includes affective components (e.g. grief after loss of place), cognitive components (e.g. knowledge and memories related to a place) and behavioural components (e.g. efforts to return to a place) – thus resembling the tripartite structure known from other constructs in social psychology (e.g. attitude; Rosenberg & Hovland, 1960). The “place” dimension (“What is the attachment to?”) refers to the – abovementioned – distinction between social and physical attachment (Riger & Lavrakas, 1981). Droseltis and Vignoles (2010) differentiate between four different dimensions of place attachment, based on a review of the existing definitions of the construct. Their integrative model describes place attachment in terms of self-extension, environmental fit, place-self congruity, and emotional attachment. Whereas self-extension refers to perceptions of the place as part of the self (i.e. “inclusion of the place in the self”), environmental fit refers to people’s subjective sense of fitting into their physical environment (i.e. rootedness). Place-self congruity describes the extent of perceived match between the place and the attitudes and values of a person. Finally, emotional attachment denotes affective people-place bonds, as acknowledged by most measures of place

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<sup>6</sup> Obviously, place attachment may refer to different types of places, ranging from small entities (e.g. “my room”), to larger physical spaces (e.g. continents; Lewicka, 2011). Most research, however, has focused on neighborhoods or communities (Giuliani, 2003)

attachment. Whereas Scannell and Gifford explicitly differentiate between physical and social attachment, Droseltis and Vignoles apply “place” as a more abstract category in their operationalization of the four dimensions (e.g. “I feel this place is part of who I am”). However, they include so-called social links to places as predictors of place attachment in their analysis, referring to e.g. genealogical links (i.e. “My origins are in this place”).

In sum, both models apply multiple (affective and cognitive) components to describe people-place relations, thus somewhat resembling multidimensional models of social identification (e.g., Leach et al., 2008). Furthermore, the distinction between social and physical attachment may provide a link to social identities. Place identity may easily be conceived of as a social identity (i.e., membership in a spatially defined group), yet previous measures have sometimes intermingled identification with physical spaces and with social groups. In the current analysis, we have applied a broad notion of people-place bonds and have not distinguished between physical and social place attachment. Furthermore, we have also included studies that refer to place identity (or similar concepts).

Turning to environmental issues, the main reason for our interest in place attachment is to investigate its (relative) predictive power for pro-environmental intentions and behaviour. Research on the relationship between place attachment and pro-environmental behaviours, however, presents a somewhat mixed picture (see Carrus et al., 2014). Whereas some authors found a positive association between the two constructs (e.g. Vaske & Kobrin 2001), other studies reported no significant correlations or even negative correlations (e.g. Hernandez et al., 2010; Bonaiuto et al. 2002). To clarify this, we included studies on people-place bonds in our meta-analysis.

## 2.3 Method

### 2.3.1 Literature search and selection of studies

The calculations in this report are based on previously published data. The following criteria were applied to select data for inclusion in the analysis. (1) The data has to be published in a scientific journal or in an edited book. (2) The dependent variable has to be an environmentally-relevant behaviour or an environmentally-relevant behavioural intention. (3) Among the independent variables has to be at least one of the following: social identity, environmental identity, connectedness to nature, or place identity. Examples of different measures that capture these constructs are listed in Table 2.1. (4) Correlations between the respective dependent and independent variables and the sample size need to be reported in the paper.

Note that, technically, we conduct eight separate meta-analyses between variable pairs, as explained in detail in section 2.3.3. The above inclusion criteria were used to select the entire dataset for these analyses.

**Table 2.1: Independent variables included in the meta-analyses**

Variable	Specific measure	Source (example)
Social identity	Community identification	Van Vugt (2001)
	Group identification	Masson & Fritsche (2014)
	Identification with all humanity	McFarland et al. (2012)
	Identification with one’s neighbourhood	Valera & Guàrdia (2002)
	Identification with potential victims of climate change	Hart & Nisbet (2012)
	Identification with the environmental movement	Brunsting & Postmes (2002)
	Identification with environmentalists	Dono et al. (2010)
	Identification with the world	Buchan et al. (2011)
	National identity	Rabinovich & Morton (2012)
	Neighbourhood cohesion	Uzzell et al. (2002)

Environmental identity	Party identification	McCright & Dunlap (2011)
	Political ideology	McCright & Dunlap (2011)
	Sense of community	Dixon et al. (2015)
	Conservationist identity	Lokhorst et al. (2014)
	Ecological identity	Walton & Jones (2017)
	Energy conserver identity	van der Werff et al. (2013b)
	Environmental identity <sup>7</sup>	Clayton (2003)
	Environmental gardener identity	Kiesling & Manning (2010)
	Environmental self-identity	van der Werff et al. (2013a)
	Green consumer identity	Sparks & Shepherd (1992)
Connectedness to nature	Recycler identity	Terry et al. (1999)
	Water conserver identity	Lauren et al. (2016)
	All-inclusive identity <sup>8</sup>	Leary et al. (2008)
	Commitment to nature	Davis et al. (2009)
	Connectedness to nature	Mayer & Frantz (2004)
	Connectivity with nature	Dutcher et al. (2007)
	Disposition to connect with nature	Brügger et al. (2011)
	Emotional affinity toward nature	Kals et al. (1999)
	Implicit connection with nature	Schultz et al. (2004)
	Inclusion of nature in self	Schultz (2001)
Place identity	Love and care for nature	Perkins (2010)
	Nature bonding	Raymond et al. (2011)
	Nature relatedness	Nisbet et al. (2009)
	Place attachment	Bonaiuto et al. (2002)
	Place identity	Raymond et al. (2011)

We located papers potentially relevant for our analyses using two search strategies:

The main strategy consisted of searching five electronic databases of scientific literature (PsycINFO, Sage, ScienceDirect, Scopus, and Web of Science) using different combinations of search terms, such as “connectedness to nature”, “connectivity with nature”, “ecological identity”, “energy-saver”, “environmental identity”, “environmentalist identity”, “environmentally conscious consumer”, “environmentally friendly consumer”, “green consumer”, “green self-identity”, “group identification”, “inclusion of nature in self”, “place identity”, “pro-environmental identity”, and “social identity”. In order not to miss potentially relevant studies, we also used combinations of a number of search terms that only have a more distant link with the focal variables, for example “norm” and “theory of planned behaviour” (as identity variables sometimes occur in papers focusing on norms or as additions to established theories like the theory of planned behaviour, see e.g. Sparks & Shepherd, 1992; Wenzel, 2004). When applicable, we used both American and British English spelling.

The second search strategy consisted of ancestry and descendancy searches, i.e., looking up potentially relevant studies that have been cited in or that have cited papers located via the database search.

<sup>7</sup> Clayton’s (2003) Environmental Identity Scale is classified here under the category of environmental identity. We concede, however, that it can also be seen as a measure of connectedness to nature (Tam, 2013; Restall & Conrad, 2015), as the scale contains also items like “I think of myself as part of nature, not separate from it.” Furthermore, some items of the Environmental Identity Scale refer to social identity aspects (e.g. “I have a lot in common with environmentalists as a group.”).

<sup>8</sup> Items referring to animate and inanimate entities in the natural world.

With these two search strategies, we located a set of 38,039 potentially relevant papers. This number includes duplicate hits (e.g., when the same paper was located in two different databases). We next screened the abstracts of these papers, and we retained papers that could not be unequivocally excluded based on our inclusion criteria.<sup>9</sup> This resulted in a selection of 1,755 papers. We next inspected these papers to determine whether they met our inclusion criteria. This resulted in a final selection of 89 papers to be included in the present meta-analysis.

### 2.3.2 Coding procedures

#### Each study was coded for the following characteristic:

- Type of study: 1 = cross-sectional questionnaire study, 2 = longitudinal questionnaire study, 3 = experiment (excl. field experiments), 4 = field experiment
- Type of recruitment: 1 = random sample, 2 = convenience sample, 3 = clustered sample, 4 = stratified random sample
- Sample size
- Type of sample: 1 = student sample, 2 = non-student or mixed sample (excl. representative samples), 3 = representative sample
- Mean age in the sample
- Gender composition of the sample
- Country where the study was conducted
- Country where the study was conducted – individualism-collectivism score. We assigned an individualism-collectivism score to each country (based on Hofstede et al., 2010), with higher scores indicating greater country-level individualism. When an observation came from a study conducted in multiple countries, we did not assign any score (this concerns Buchan et al., 2011; Bamberg et al. 2015; Bartels & Reinders, 2016).<sup>10</sup>
- Topic: 1 = smart energy technology, 2 = electric mobility, 3 = energy in buildings, 4 = energy (other than cat. 3), 5 = transport (other than cat. 2), 6 = other conservation, 7 = recycling and handling of waste, 8 = environmentally friendly products, 9 = policy support, 10 = other, 11 = various environmental behaviours (multi-behaviour scale)
- Dependent variable
- Dependent variable – reliability
- Dependent variable – example item
- Type of dependent variable: 1 = behaviour, 2 = intention. Hypothetical product choice (e.g., van der Werff et al., 2013a) and policy support (e.g., Hoffarth et al., 2016) were coded as intention.
- Independent variable: 1 = connectedness to nature, 2 = environmental identity, 3 = place identity, 4 = social identity
- Subtype of social identity: pro-environmental, neutral, anti-environmental
- Independent variable – reliability

<sup>9</sup> One is usually not able to conclude that all criteria have been met just by reading the abstract. But it is typically possible to tell when at least one criterion has not been met, which then leads to paper exclusion.

<sup>10</sup> Among the most individualistic countries are The United States (score of 91), Australia (90), and United Kingdom (89). European countries score fairly high on individualism, for example The Netherlands (80), Italy (76), Sweden (71), and Germany (67), with somewhat lower values found in Austria (55) and Spain (51). Asian countries are generally more collectivistic, for example China (20) and Hong Kong (25). However, countries with relatively high levels of individualism were overrepresented in our sample.

- Independent variable – example item
- Effect size. Bivariate zero-order correlations between a dependent variable and an independent variable were used as measures of effect size.

### 2.3.3 Overview of analysis

Several studies contained multiple relevant outcome or predictor variables (e.g., Dean et al. 2012; Tam, 2013; Lauren et al., 2016). Thus, to ensure independence of observations included in each meta-analysis (Hunter & Schmidt, 1990), we conducted separate meta-analyses for different combinations of outcome variables (intention, behaviour) and predictor variables (social identity, environmental identity, connectedness to nature, and place identity). This resulted in eight separate meta-analyses, which estimated the pooled correlation between the following variable-pairs, respectively.

#### The variable pairs analysed in the meta-analysis are:

- intention and social identity;
- intention and environmental identity;
- intention and connectedness to nature;
- intention and place identity;
- behaviour and social identity;
- behaviour and environmental identity;
- behaviour and connectedness to nature;
- behaviour and place identity.

Bivariate correlations between an outcome variable and a predictor variable extracted from primary studies were used as observations in the analyses. When a study contained multiple outcome variables of the same type (such as two different intention measures) or multiple predictors of the same type (such as two different scales both measuring what we classify as connectedness to nature, see e.g. Mayer & Frantz, 2004; Martin & Czellar, 2016), we aggregated the correlations according to the “shifting unit of analysis” method proposed by Cooper (1998).

Following the procedures outlined so far, we arrived at 168 correlations extracted from primary studies (see Table 2.2).

Before estimating the population effect size, we converted the correlations from primary studies to a standard normal metric using Fisher  $r$ -to- $Z$  transformation (Hedges & Olkin, 1985). The population  $Z$ -scores we obtained were transformed back to  $r$  at the end.

We obtained the estimate of the correlation size in the population from which the observations<sup>11</sup> are drawn by estimating a random effects model. Random effects models assume the presence of unidentified sources of variance that are randomly distributed across studies (e.g., due to different procedures used to collect data). This assumption was supported by a series of significant  $Q$ -tests (reported in Table 2.3) which reject the assumption of homogeneity in correlations across studies included in a given meta-analysis. The application of a random effects model means that the pooled correlations are estimated by weighing the observations by the inverse of a variance

<sup>11</sup> In this context, observations refer to correlations extracted from primary studies.



term including both their within- and between-study variance components (Hedges & Vevea, 1998; DerSimonian & Laird, 1986).

For each analysis, we also calculated Rosenthal's (1979) fail-safe  $N$  and generated a funnel plot in order to address the possibility of a publication bias. Meta-analytic calculations were performed using the Comprehensive Meta-Analysis software (CMA).<sup>12</sup> The MedCalc software<sup>13</sup> was used to compare the size of correlations.

## 2.4 Results

In total, 168 correlations were gathered from 125 separate samples with 58,207 participants in total.

Table 2.2 lists the number of correlations included in each meta-analysis ( $k$ ), along with a more detailed information on the actual studies included, the correlations reported in each study ( $r$ ), and the number of participants on which each of these within-study correlations is based ( $n$ ).

**Table 2.2: Overview of data used in the meta-analyses**

Meta-analysis	$k$	Included studies	$r$	$n$
Intention and social identity	33	Bamberg et al. (2015)	.74	652
		Bartels & Onwezen (2011)	.39	1006
		Barth et al. (2011)	.26	450
		Bonaiuto et al. (1996)	-.02	347
		Brunsting et al. (2002)	.37	738
		Buttel et al. (1978)	.11	548
		Clarke et al. (2017)	.46	334
		Clayton et al. (2013) - Study 2	.28	378
		Clements et al. (2014)	.21	1430
		Crimston et al. (2016) - Study 3	.10	289
		Dono et al. (2010)	.57	131
		Dunlap et al. (2008) - 1997 data	.13	1000
		Dunlap et al. (2008) - 2001 data	.18	1000
		Dunlap et al. (2008) - 2002 data	.22	1000
		Dunlap et al. (2008) - 2003 data	.27	1000
		Dunlap et al. (2008) - 2004 data	.32	1000
		Dunlap et al. (2008) - 2005 data	.31	1000
		Dunlap et al. (2008) - 2006 data	.30	1000
		Dunlap et al. (2008) - 2007 data	.36	1000
		Dunlap et al. (2008) - 2008 data	.34	1000
		Hoffarth et al. (2016)	.45	384
		Kalkbrenner et al. (2016)	.18	954
		Lapinski et al. (2007)	.19	72
		Masson et al. (2014) - Study 1	-.04	203
		Masson et al. (2014) - Study 2	.14	205
		Masson et al. (2016) - Study 2	.10	118
		Reese & Kohlmann (2015)	.58	68
		Rees & Bamberg (2014)	.15	538

<sup>12</sup> <https://www.meta-analysis.com/>

<sup>13</sup> <https://www.medcalc.org/>



Intention and environmental identity	28	Renger & Reese (2016)	.40	469
		White et al. (2009 - Study 2)	.06	175
		Wolsko et al. (2016) - Study 1	.47	185
		Wolsko et al. (2016) - Study 2	.40	187
		Wolsko et al. (2016) - Study 3	.37	97
		Barbarossa et al. (2015) - Belgium	.43	600
		Barbarossa et al. (2015) - Denmark	.54	661
		Barbarossa et al. (2015) - Italy	.54	794
		Clayton et al. (2013) - Study 2	.35	378
		Davis et al. (2011)	.66	248
		Dean et al. (2012)	.60	499
		Fielding et al. (2008)	.86	169
		Geng et al. (2015)	.35	113
		Jara et al. (2014)	.49	306
		Johe et al. (2016)	.64	252
		Lauren et al. (2016) - Study 1	.37	473
		Lauren et al. (2016) - Study 2	.13	165
		Li et al. (2016)	.54	474
		Lois et al. (2015)	.40	595
		Lokhorst et al. (2014)	.79	94
		Nigbur et al. (2010) - Study 1	.68	527
		Nigbur et al. (2010) - Study 2	.59	264
		Robinson & Smith (2002)	.30	547
		Sparks & Shepherd (1992)	.37	261
		Tam (2013) - Study 1	.59	322
		Tam (2013) - Study 2	.70	185
		Terry et al. (1999)	.56	143
		van der Werff et al. (2013b) - Study 1	.47	138
		van der Werff et al. (2013b) - Study 2	.33	45
		van der Werff et al. (2013b) - Study 3	.34	70
		van der Werff et al. (2014a) - Study 1	.44	468
		White & Hyde (2011)	.68	200
		Yazdanpanah & Forouzani (2015)	.36	389
Intention and connectedness to nature	16	Crimston et al. (2016) - Study 3	.15	289
		Davies et al. (2011)	.56	248
		Geng et al. (2015)	.26	113
		Gosling & Williams (2010)	.23	141
		Haws et al. (2014) - Study 1c	.21	167
		Jara et al. (2014)	.41	306
		Jaskiewicz (2014)	.48	164
		Lokhorst et al. (2014)	.38	94
		Martin & Czellar (2016) - Study 2a	.40	107
		Martin & Czellar (2016) - Study 2b	.21	585
		Nisbet et al. (2013) - Study 1	.56	184
		Nisbet et al. (2013) - Study 3	.64	354
		Raudsepp (2005)	.43	987
		Sparks et al. (2014) - Study 2	.34	163
		Tam (2013) - Study 1	.48	322
		Tam (2013) - Study 2	.64	185

Intention and place identity	12	Bonaiuto et al. (2002) - Study 1	-.39	115
		Bonaiuto et al. (2002) - Study 2	-.27	854
		Devine-Wright et al. (2010) - Colwyn Bay	-.09	236
		Devine-Wright et al. (2010) - Llandudno	-.16	219
		Gosling & Williams (2010)	.08	141
		Hernández et al. (2010)	.02	264
		Jaskiewicz (2014)	.32	164
		Lokhorst et al. (2014)	-.07	94
		Ramkissoo et al. (2017) - Subsample 1	.39	339
		Ramkissoo et al. (2017) - Subsample 2	.38	296
		Raymond et al. (2011) - Northern and Yorke	-.02	659
		Raymond et al. (2011) - SAMDB	.02	664
Behaviour and social identity	17	Bartels & Hoogendam (2011)	.57	961
		Bartels & Reinders (2010)	.57	1001
		Bartels & Reinders (2016)	.44	1440
		Brick et al. (2017) - Study 1	.09	349
		Brunsting et al. (2002)	.18	738
		Buchan et al. (2011)	.06	1195
		Clements et al. (2014)	.15	1430
		Cojuharenco et al. (2016)	.25	638
		Dono et al. (2010)	.59	131
		Gupta et al. (2009)	.34	190
		Lee et al. (2015)	.19	324
		Miafodzyeva et al. (2013)	.14	248
		Prati et al. (2017)	.42	298
		Reese & Kohlmann (2015)	.25	68
		Renger & Reese (2016)	.25	469
		Wolsko et al. (2016) - Study 2	-.08	187
		Wolsko et al. (2016) - Study 3	-.03	97
Behaviour and environmental identity	21	Brick et al. (2017) - Study 1	.24	349
		Brügger et al. (2011)	.54	1309
		Davies et al. (2011)	.51	248
		Dean et al. (2012)	.49	499
		Dermody et al. (2015) - Study 1	.69	1037
		Dermody et al. (2015) - Study 2	.65	1025
		Dresner et al. (2015)	.27	172
		Kiesling & Manning (2010)	.44	466
		Lauren et al. (2016) - Study 1	.32	473
		Lauren et al. (2016) - Study 2	.26	165
		Nigbur et al. (2010) - Study 2	.37	264
		Olivos et al. (2011)	.43	282
		Tam (2013) - Study 1	.36	322
		Tam (2013) - Study 2	.66	185
		Terry et al. (1999)	.51	114
		Unanue et al. (2016) - Chile	.36	257
		Unanue et al. (2016) - UK	.38	958
		van der Werff et al. (2014a) - Study 1	.38	468
		Walton et al. (2017)	.71	497
		Watson et al. (2015)	.59	243

Behaviour and connectedness to nature	31	White & Hyde (2011)	.55	200
		Barbaro et al. (2016) - Study 1	.34	360
		Barbaro et al. (2016) - Study 2	.55	296
		Beery & Wolf-Watz (2014)	.15	822
		Brügger et al. (2011)	.36	1309
		Davies et al. (2011)	.40	248
		Davis et al. (2009) - Study 1	.55	71
		Gosling & Williams (2010)	.22	141
		Grajal et al. (2016)	.32	3588
		Haws et al. (2014) - Study 1c	.49	167
		Hedlund-de Witt et al. (2014)	.21	952
		Hoot et al. (2011)	.37	210
		Markowitz et al. (2012)	.52	115
		Markowitz et al. (2012) - Study 2	.52	115
		Martin & Czellar (2016) - Study 3a	.34	189
		Martin & Czellar (2016) - Study 3b	.36	178
		Mayer & Frantz (2004) - Study 2	.44	102
		Mayer & Frantz (2004) - Study 4	.45	135
		Mayer & Frantz (2004) - Study 5	.29	57
		Nisbet & Zelenski (2013) - Study 1	.48	184
		Nisbet & Zelenski (2013) - Study 3	.60	354
		Nisbet & Zelenski (2013) - Study 4, community	.57	84
		Nisbet & Zelenski (2013) - Study 4, students	.55	123
		Nisbet et al. (2009) - Study 1	.59	184
		Nisbet et al. (2013) - Study 1	.41	184
		Nisbet et al. (2013) - Study 3	.55	354
		Olivos et al. (2013)	.27	286
		Raudsepp (2005)	.27	987
		Schultz et al. (2004) - Study 2	.16	98
		Stritch & Christensen (2016)	.44	843
		Tam (2013) - Study 1	.28	322
		Tam (2013) - Study 2	.57	185
Behaviour and place identity	10	Devine-Wright et al. (2010) - Colwyn Bay	-.02	236
		Devine-Wright et al. (2010) - Llandudno	-.22	219
		Gosling & Williams (2010)	.06	141
		Lawrence et al. (2012)	.55	115
		Lee et al. (2015)	.46	561
		Raymond et al. (2011) - Northern and Yorke	.05	659
		Raymond et al. (2011) - SAMDB	.07	664
		Scannell & Gifford (2010b)	.40	104
		Vaske & Kobrin (2001)	.63	182
		Zhang et al. (2014)	.37	642

### 2.4.1 Main results

Table 2.3 presents the main results. The second column reports the pooled (i.e. meta-analytic) correlations between the identity measures and the measures of pro-environmental behaviours/intentions. Columns three and four indicate 95% confidence intervals.

With the exception of the pooled correlation between intention and place identity, all reported effect sizes are statistically significantly different from zero at  $p < .05$ , which can be seen by looking at the reported confidence intervals.<sup>14</sup>

The pooled correlations are mostly of medium size. The correlations with environmental identity are medium-to-large (according to guidelines set forth by Cohen, 1988). Only the pooled correlation between place identity and intention is close to zero. The non-significant effect for place identity is in line with previous findings in this field (see Carrus et al., 2014). A more detailed discussion on this issue will be presented in the following sections.

**Table 2.3: Main results**

Meta-analysis	Pooled effect size	95% CI (lower bound)	95% CI (upper bound)	Q	Fail-safe N
Intention and social identity	.285	.246	.324	558.49***	2640
Intention and environmental identity	.526	.468	.580	370.87***	20227
Intention and connectedness to nature	.412	.329	.488	145.13***	3092
Intention and place identity	.021	-.120	.161	214.61***	-
Behaviour and social identity	.268	.225	.310	478.89***	3200
Behaviour and environmental identity	.477	.406	.542	360.06***	3343
Behaviour and connectedness to nature	.409	.363	.453	248.15***	2978
Behaviour and place identity	.251	.084	.404	224.56***	458

Note: \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

We report Cochran's  $Q$  in the fifth column. A significant  $Q$  statistic suggests the presence of heterogeneity in effect sizes across studies within a given meta-analysis. I.e., some studies report relatively small effects while other studies report significantly larger effects. This might indicate the influence of moderator variables that render the effects relatively more – or less – pronounced in certain cases. These moderators can be either methodological (e.g., student vs. representative samples) or substantive in nature (e.g., situational constraints that limit the impact of psychological factors). We report moderator analyses in Section 2.4.3.

## 2.4.2 The file drawer problem and publication bias

The fail-safe  $N$  values reported in the last column in Table 2.3 indicate the number of studies with null results (average  $Z$ -value of 0) that would be needed to make the pooled correlation reported in column two no longer significant at  $p = .05$  (Rosenthal, 1979). Large fail-safe  $N$ s mean that unpublished, unretrieved and future studies with null results are unlikely to threaten the basic conclusions drawn from the meta-analytical calculations, as there would need to be a large number of such studies. According to Rosenthal's (1979) guidelines, a fail-safe  $N$  greater than the tolerance value (i.e.,  $5k + 10$ , where  $k$  is the number of effect sizes included in a given calculation, see Table 2.2) indicates that the pooled correlation is likely to be resistant to unpublished, unretrieved and future null results. As can be seen in Table 2.3, all fail-safe  $N$ s are substantially larger than the associated tolerance values.

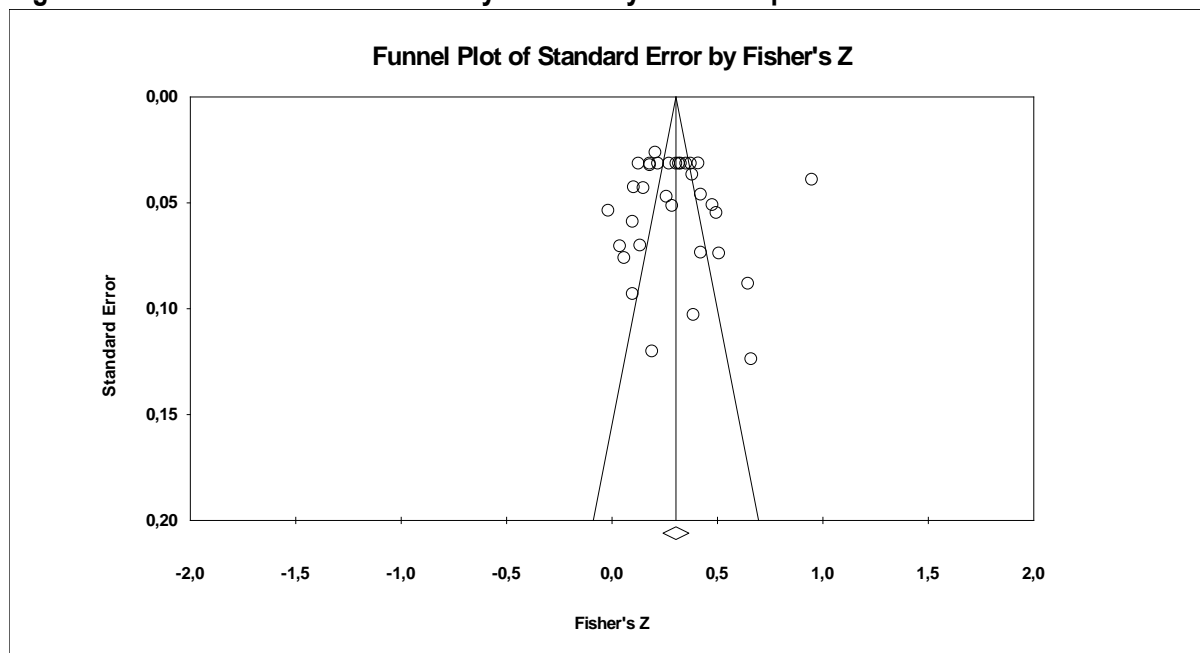
For each meta-analysis, Figures 2.1-2.8 plot the observations' effect sizes (expressed as  $Z$ -scores) against their associated standard errors (Sterne & Egger, 2001). Once again, "observations" refer to correlations extracted from

<sup>14</sup> Throughout the paper we report two-tailed tests.

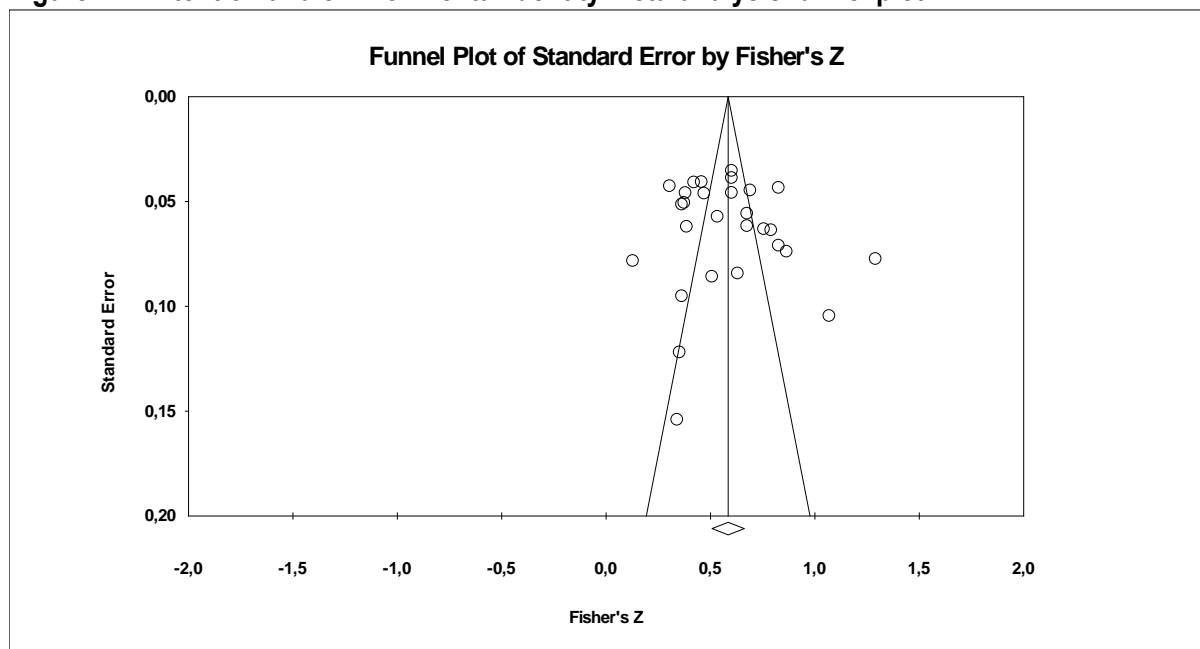
primary studies. Thus, for example, Figure 2.1 displays the 33 effect sizes and their associated standard errors that were included in the “intention and social identity” meta-analysis.

Inspection of the funnel plots (a graphical technique in which the standard error of each study’s effect size is plotted against the standardized effect size itself) does not suggest the presence of systematic publication biases, as indicated by the clustering of observations between the slanting lines representing 95% confidence intervals around the pooled effect size estimate (the vertical line). Taken together, these indicators suggest that the results of our meta-analyses are not affected by problems concerning selective publication. In fact, lack of publication bias is demonstrated by a symmetrical cloud of studies centred around the population effect size.

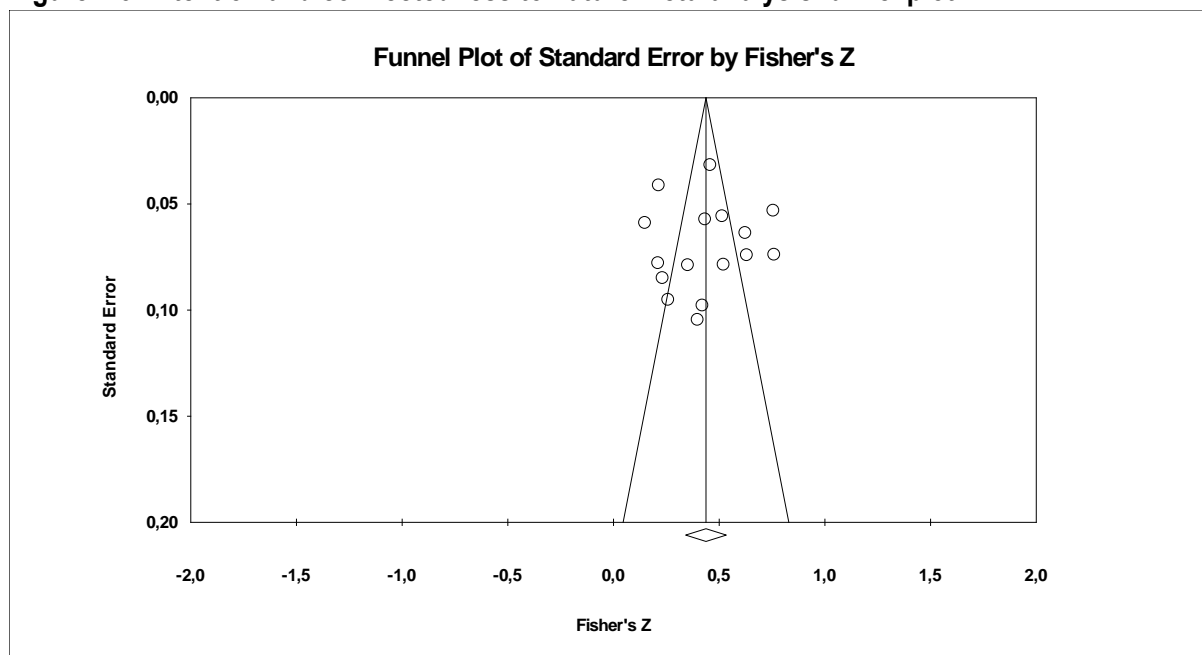
**Figure 2.1: Intention and social identity meta-analysis funnel plot**



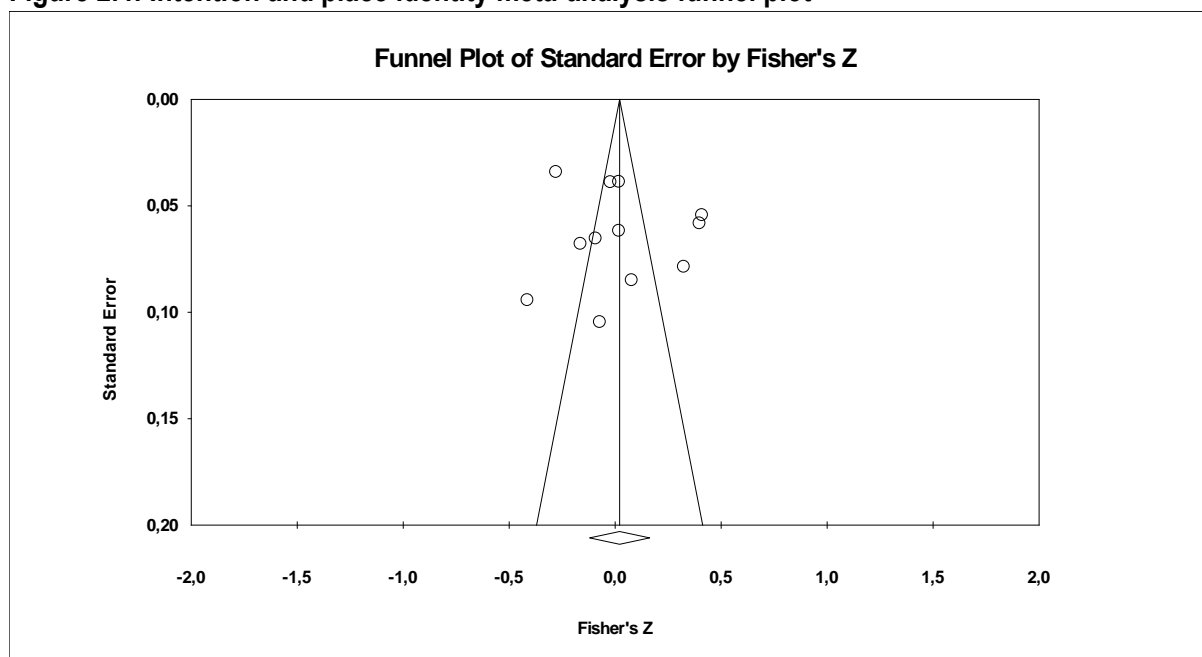
**Figure 2.2: Intention and environmental identity meta-analysis funnel plot**



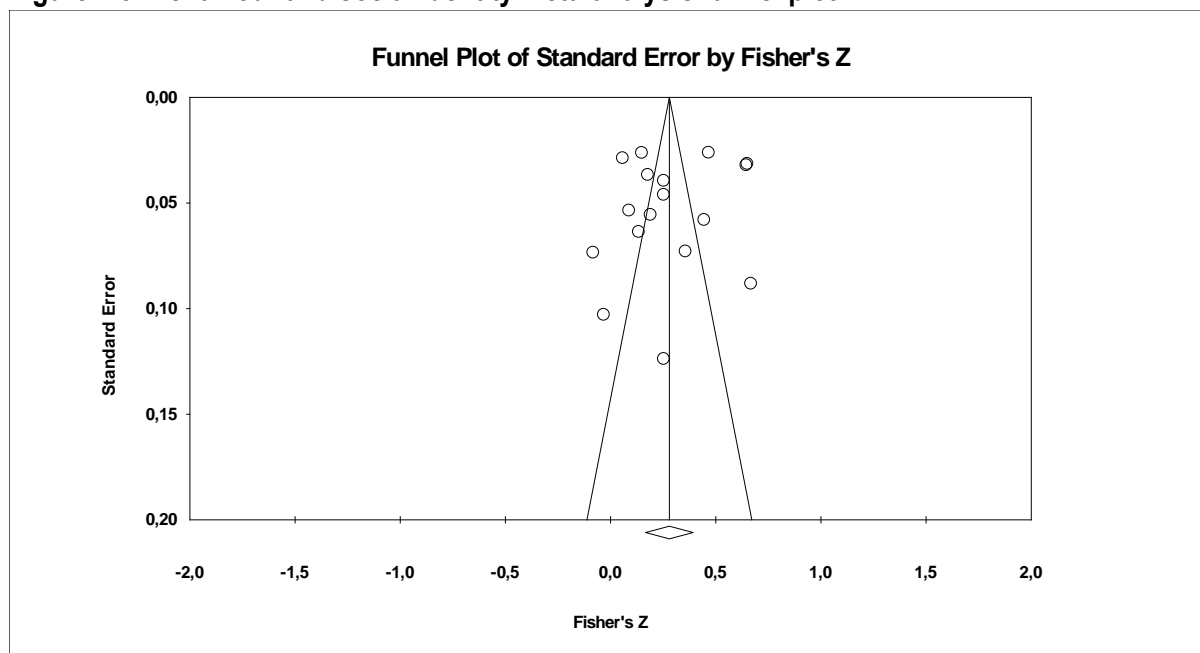
**Figure 2.3: Intention and connectedness to nature meta-analysis funnel plot**



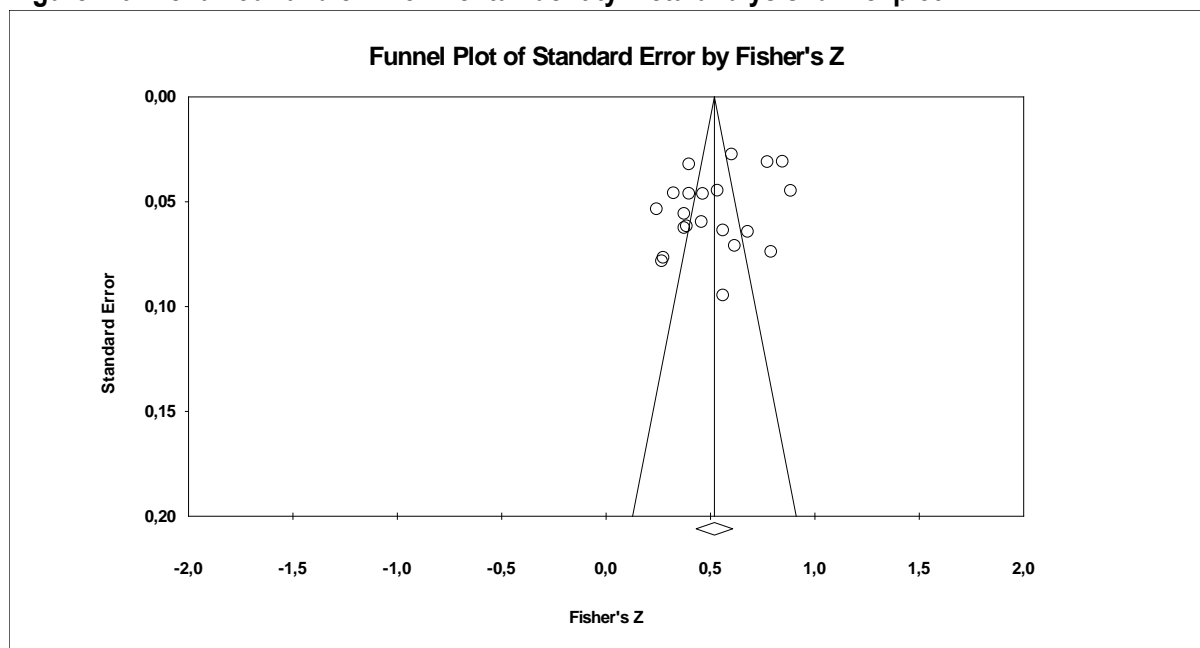
**Figure 2.4: Intention and place identity meta-analysis funnel plot**



**Figure 2.5: Behaviour and social identity meta-analysis funnel plot**

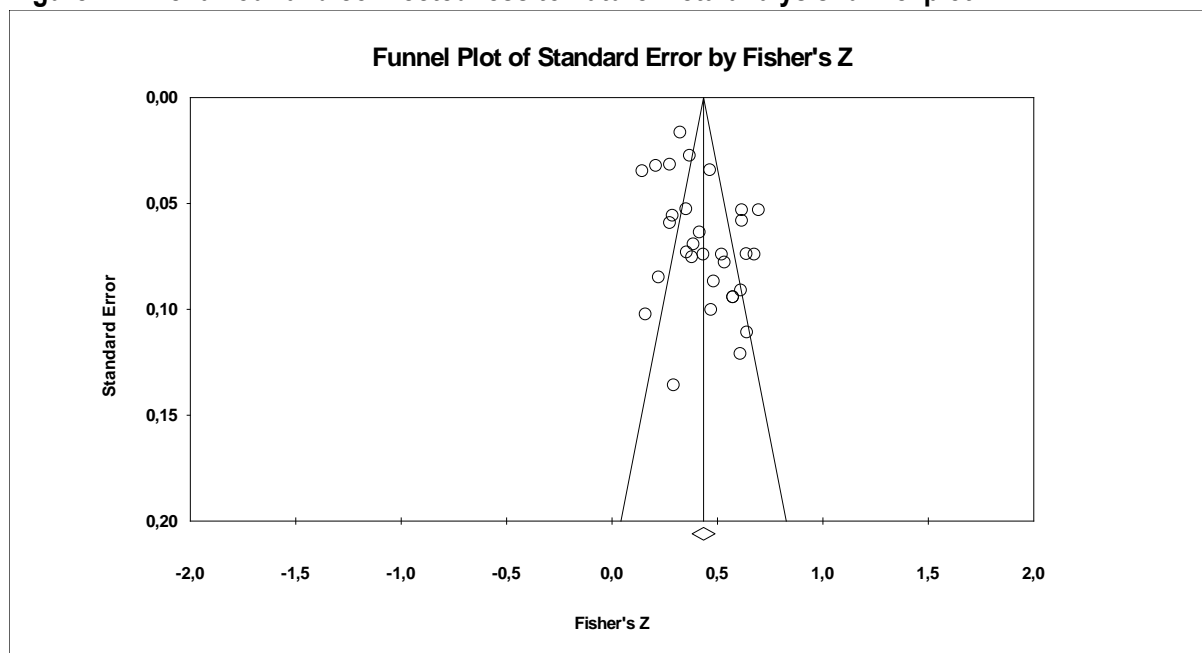


**Figure 2.6: Behaviour and environmental identity meta-analysis funnel plot**

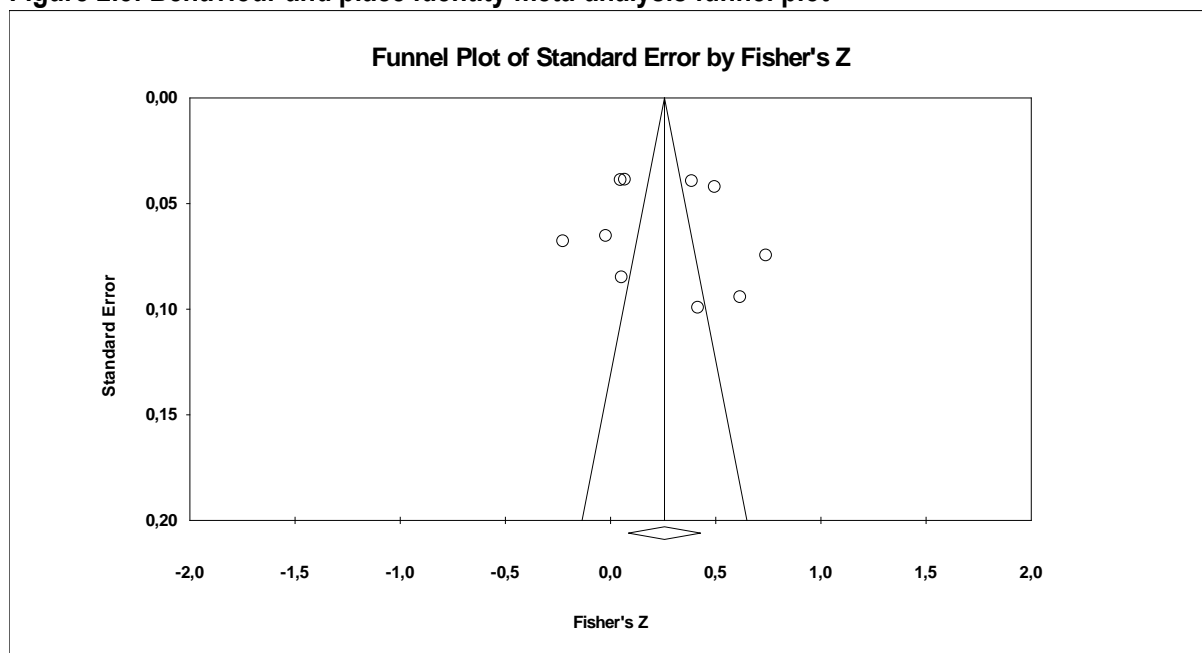




**Figure 2.7: Behaviour and connectedness to nature meta-analysis funnel plot**



**Figure 2.8: Behaviour and place identity meta-analysis funnel plot**



## 2.4.3 Moderator analyses

### 2.4.3.1 Moderation of effect sizes by social identity type

We conduct moderator analyses by social identity type in the two meta-analyses in which social identity serves as the predictor. The moderator variable is the extent to which a given social identity can be seen as pro-environmental (i.e., the degree to which pro-environmental behaviour is perceived as normative for the group). We coded our moderator variable using the following three categories: pro-environmental social identity, neutral social identity, and anti-environmental social identity (see the first column in Table 2.4). Table 2.4 presents the computed pooled effect sizes and their 95% confidence intervals, along with the number of observations on which each pooled effect size is based ( $k$ ).

**Table 2.4: Moderation by social identity type**

	Intention and social identity meta-analysis		Behaviour and social identity meta-analysis	
	$k$	Pooled $r$ [95% CI]	$K$	Pooled $r$ [95% CI]
Overall effect	33	.285 [.246, .324]	17	.268 [.225, .310]
Pro-environmental social identity	3	.524 [.233, .728]	4	.539 [.456, .613]
Neutral social identity	28	.247 [.204, .289]	10	.150 [.071, .227]
Anti-environmental social identity	0	-	1	.344 [.212, .464]
Unclassified	2	-	2	-

Note: Values for the unclassified cases are not displayed.

Unsurprisingly, pro-environmental social identity is – descriptively – more closely linked to pro-environmental intentions ( $r = .524$ ) than neutral social identity ( $r = .247$ ). Similarly, pro-environmental social identity is – descriptively – more closely linked to pro-environmental behaviour ( $r = .539$ ) than neutral social identity ( $r = .150$ ). These differences are, however, not statistically significant at conventional levels according to Fisher's Z-test (Eagly & Wood, 1994). The lack of significant differences is presumably due to the small number of observations.

### 2.4.3.2 Moderation of effect sizes by participants' age

For each meta-analysis, we conduct moderator analyses by means of a random effects meta-regression, using mean age in a given sample as the moderator (see Table 2.5).

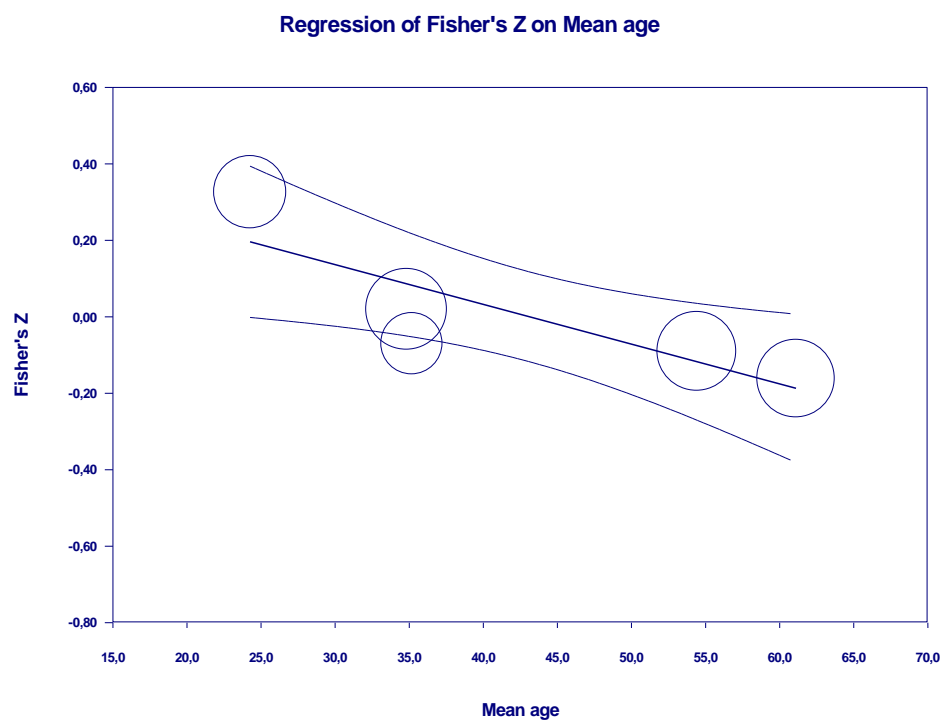
**Table 2.5: Participants' age as the moderator: Meta-regression results**

Meta-analysis	Beta	Std. Err.	95% CI (lower bound)	95% CI (upper bound)	Z
Intention and social identity	.002	.009	-.015	.019	.21
Intention and environmental identity	-.007	.005	-.017	.003	-1.42
Intention and connectedness to nature	-.012	.007	-.025	.001	-1.8†
Intention and place identity	-.010	.004	-.017	-.004	-2.99**
Behaviour and social identity	-.004	.006	-.015	.008	-.62
Behaviour and environmental identity	-.004	.003	-.010	.003	-1.16
Behaviour and connectedness to nature	-.003	.004	-.010	.004	-.78
Behaviour and place identity	-.023	.004	-.031	-.016	-5.96***

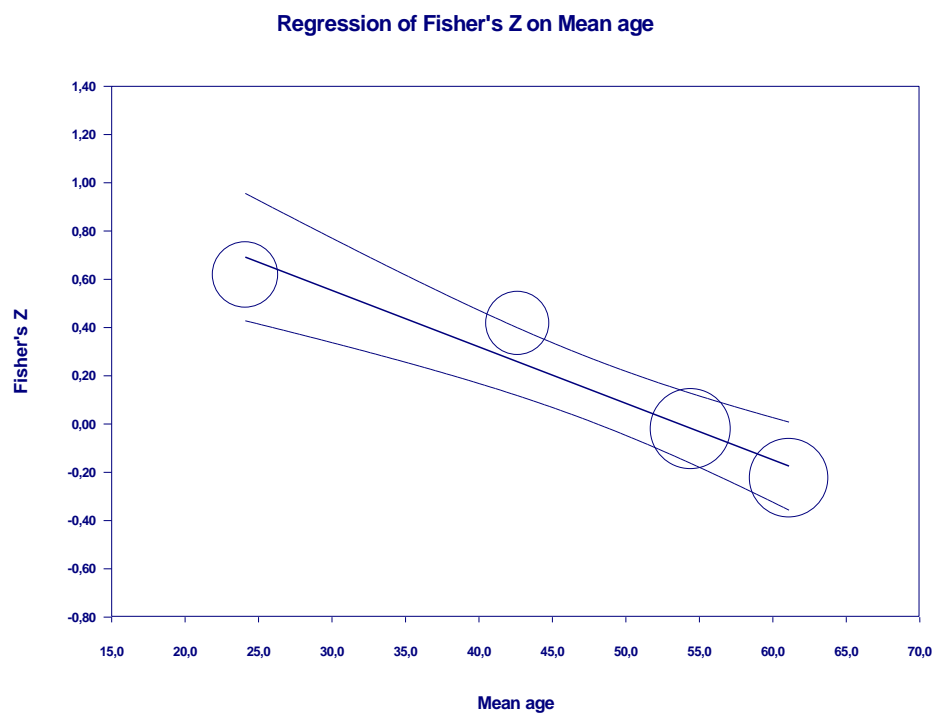
Note: †  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

The results of the meta-regression analyses show a consistent pattern: the links within the studied dependent and independent variable pairs (see the first column in Table 2.5) tend to be weaker in samples with older participants. These differences are, however, statistically significant only in two cases (intention and place identity and behaviour and place identity; see figures 2.9 and 2.10), and marginally statistically significant in case of the link between intention and connectedness to nature.

**Figure 2.9. Difference in the association between intention and place identity as a function of age.**



**Figure 2.10. Difference in the association between behaviour and place identity as a function of age.**



### 2.4.3.3 Moderation of effect sizes by participants' gender

For each meta-analysis, we conduct moderator analyses by means of a random effects meta-regression, with the proportion of women in a given sample serving as the moderator (see Table 2.6).

**Table 2.6: Proportion of women as the moderator: Meta-regression results**

Meta-analysis	Beta	Std. Err.	95% CI (lower bound)	95% CI (upper bound)	Z
Intention and social identity	.002	.006	-.009	.013	.32
Intention and environmental identity	-.004	.003	-.010	.002	-1.25
Intention and connectedness to nature	.004	.003	-.002	.010	1.2
Intention and place identity	.002	.004	-.006	.010	.45
Behaviour and social identity	.009	.004	.002	.017	2.5*
Behaviour and environmental identity	.002	.004	-.006	.011	.48
Behaviour and connectedness to nature	.006	.002	.001	.010	2.63**
Behaviour and place identity	.004	.003	-.002	.011	1.37

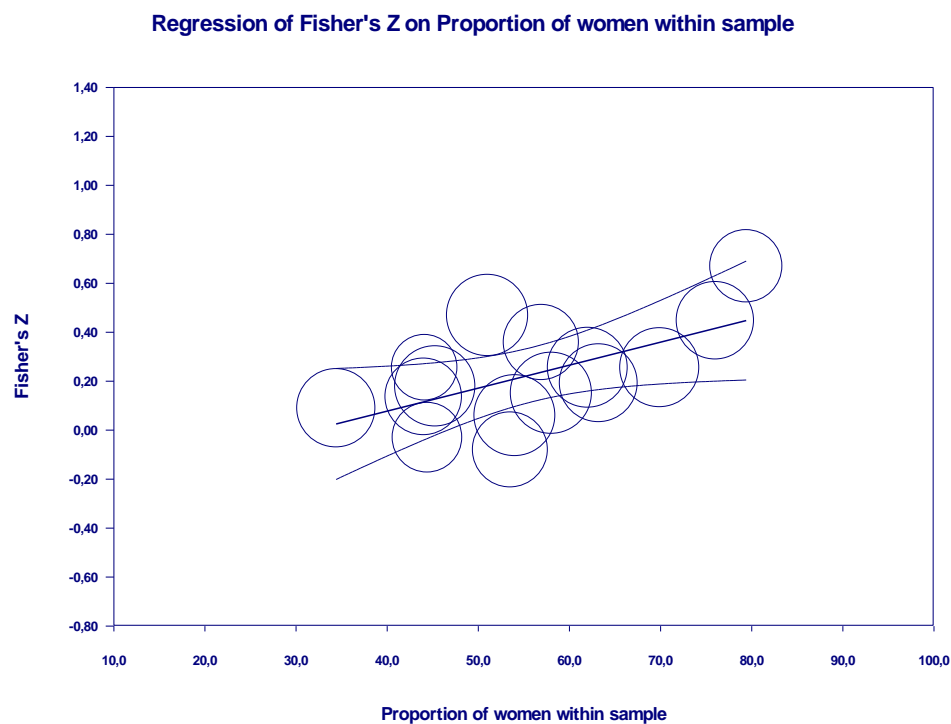
Note: \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

The results indicate that female gender has a statistically significant small positive effect on the social identity-behaviour relationship and on the connectedness to nature-behaviour relationship, i.e., the associations between these variables are stronger in samples with more females (see figures 2.11 and 2.12). Overall, however, gender does not seem to consistently affect the associations between identity and pro-environmental behaviours/intentions.

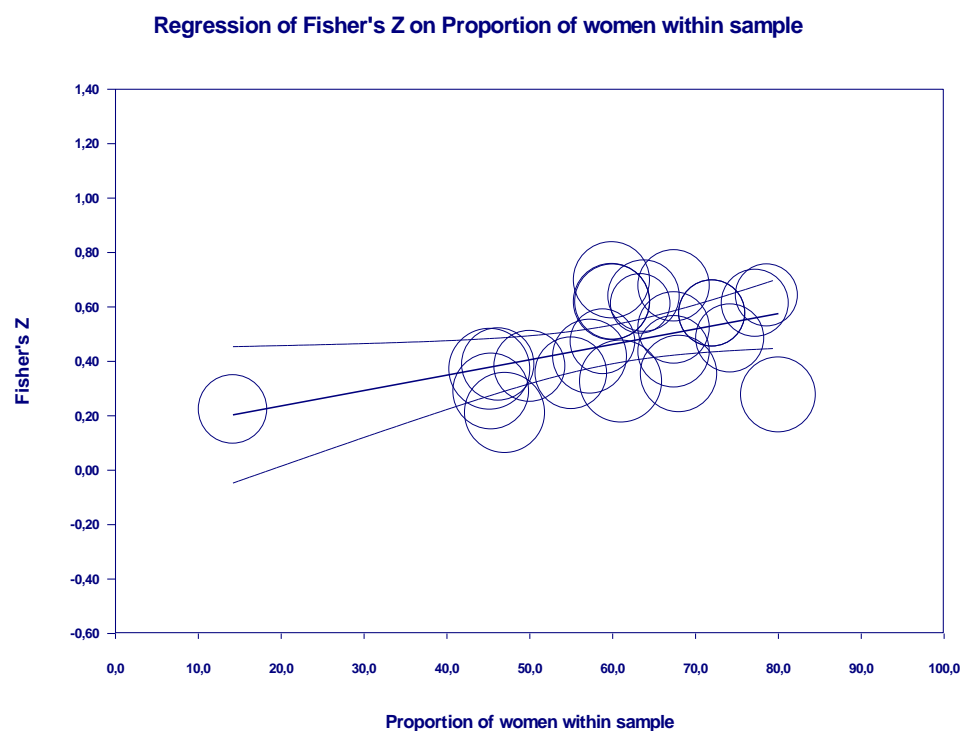
### 2.4.3.4 Moderation of effect sizes by collectivism-individualism

For each meta-analysis, we conduct moderator analyses by means of a random effects meta-regression, with country-level individualism-collectivism score serving as the moderator (Hofstede et al., 2010). We assumed that personal identity might be more predictive of behaviour in societies with high levels of individualism (versus collectivist societies), while an opposite pattern might be expected for social identity. However, the results show a moderation effect only for connectedness to nature: in fact, this factor is slightly more strongly related to pro-environmental behaviour in individualistic societies (see figure 2.13). No other differences were significant (see Table 2.7). Thus, results thus do not support our assumption.

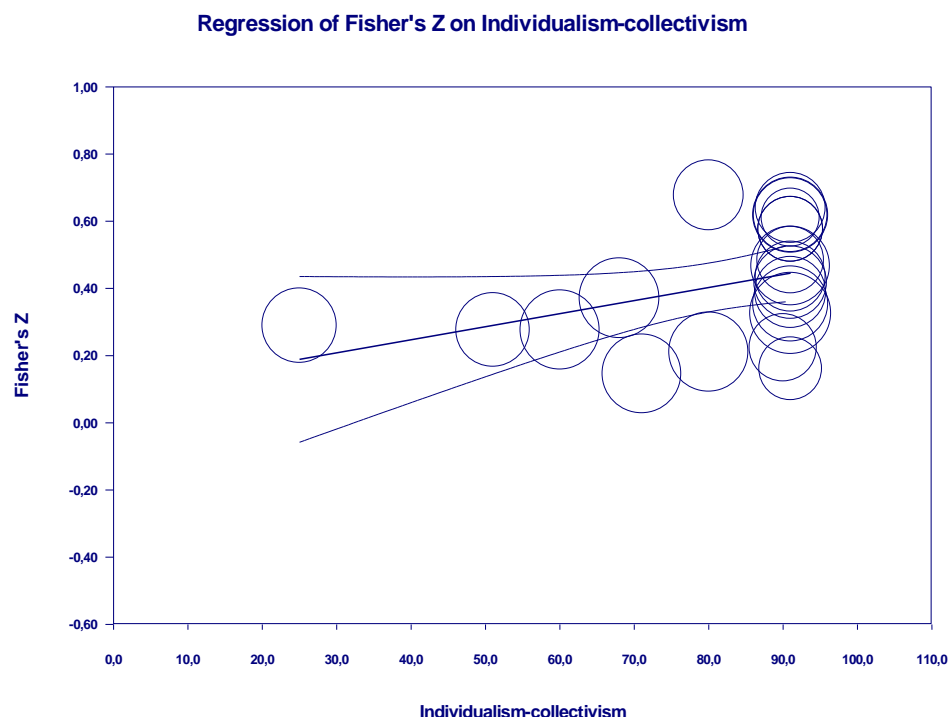
**Figure 2.11. Difference in the association between behaviour and social identity as a function of gender**



**Figure 2.12. Difference in the association between behaviour and connectedness to nature as a function of gender**



**Figure 2.13. Difference in the association between behaviour and connectedness to nature as a function of collectivism-individualism**



**Table 2.7: Individualism-collectivism as the moderator: Meta-regression results**

Meta-analysis	Beta	Std. Err.	95% CI (lower bound)	95% CI (upper bound)	Z
Intention and social identity	.002	.002	-.002	.007	1.03
Intention and environmental identity	.002	.002	-.001	.005	1.14
Intention and connectedness to nature	.002	.002	-.003	.006	.76
Intention and place identity	-.002	.009	-.02	.016	-.19
Behaviour and social identity	-.004	.007	-.017	.009	-.62
Behaviour and environmental identity	.000	.002	-.004	.004	.06
Behaviour and connectedness to nature	.004	.002	.001	.007	2.25*
Behaviour and place identity	-.003	.004	-.011	.006	-.64

Note: \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .



## 2.5 Discussion

In sum, our meta-analytic findings indicate that identity – at the individual as well as at the collective level – is a strong predictor of pro-environmental behaviours and intentions. This result is consistent across different domains of behaviour and also seems to be relatively stable in different cultural contexts. More specifically, our analyses show that connectedness to nature and social identity are moderately strongly associated with pro-environmental behaviours/intentions. The link between pro-environmental social identity and the dependent measures is medium-to-large (but this result is based on very few observations). The association between environmental identity and the dependent measures is medium-to-large. There is no statistically significant association between place identity and intention, but there is a moderately strong positive link between place identity and pro-environmental behaviour.

The results for place identity might be affected by the different measures applied. Among others, measures of place identity or place attachment can refer to attachment with physical spaces and/or with social groups. Whereas high levels of physical attachment may elicit reactions to protect the environment (e.g. support the preservation of local nature parks), the effects of social attachment might be different. For example, high levels of social (place) attachment may increase acceptance of policies to support the local economy or increase protest against projects that seem to impair economic prosperity (e.g. nature parks; Bonaiuto et al., 2002). Similarly, high place identity may increase or decrease acceptance of renewable energy infrastructure (e.g. wind parks), depending on the nature of attachment. At a more general level, an explanation for the inconsistent relations between measures of place identity (or place attachment) and ecological intentions and behaviours was provided in an earlier work by Carrus and colleagues (2014). According to these authors a positive relation between place attachment and ecological behaviour “can be explained by ‘place-protective tendencies associated with the development of emotional bonds with one’s living environment, as well as by the positive associations linking place attachment to civic engagement” (Carrus et al., 2014, p. 157). However, these authors also argue that “local economic background plays an important role in affecting not only people’s reactions to debated environmental issues, but also the links between public opinion, place attachment, and local identity” so that “when a clear local economic interest collides with specific environmental policy measures” it is more likely to expect that “place attachment might easily form the basis for anti-environmental attitudes and behaviours, such as protest or refusal to comply with environmental regulations” (Carrus et al., 2014, p. 159).

Also, generation effects may play a role in explaining heterogeneous effects of place identity, as suggested by the moderator analyses showing that place identity effects on pro-environmental intentions and behaviour were stronger in younger samples. The meaning and action implications associated with place identity may differ across generations with issues of preserving natural places having become more focal in younger generations.

The effect size of social identity effects varied along with whether the ingroup under investigation was explicitly pro-environmental, neutral, or anti-environmental in nature with the strongest effects for pro-environmental groups. This supports the notion that people are more highly motivated to act for the environment when they consider their actions as being collective and not just personal (Fritzsche et al., 2017). Of interest, even identification with those groups who were not explicitly characterized by pro-environmental goals and norms, was positively related to pro-environmental intentions and behaviour. This might be explained in different ways. First, protecting the environment has become an accepted convention or norm in the context of most groups (e.g., multinational survey studies usually find high levels of pro-environmental attitudes across countries) which is thus more strongly pursued by high identifiers. Second, as shown in the literature on social dilemmas, having a common ingroup identity increases people’s cooperation, for instance, in public goods dilemmas, which have been proposed to model environmental decision making. Third, level of ingroup identification may not just reflect group-specific affiliation but may, at least in part, be fueled by an individual’s overall prosocial tendency or even basic personality (“agreeableness”) which should, in turn, predict people’s (pro-social) pro-environmental intentions. This would indicate a spurious correlation between neutral social identity and pro-environmental intentions and behaviour. Future research should test these possible explanations.

These findings indicate that all identity variables, especially environmental identity, pro-environmental social identity and connectedness to nature, might be able to exert considerable influence on people's pro-environmental action. Future research should therefore focus on firmly establishing the causal direction of the links (and their size) between the presumed independent and dependent measures (there is some evidence that these links might be bi-directional, see van der Werff et al., 2013a, 2014a, 2014b; Lacasse, 2016; Truelove et al., 2016; Prati et al., 2017). This appears to be the logical next step in order to better develop more efficient strategies aimed at employing identity-based interventions in the field.

The links between the identity measures (especially place identity, see above) and the behaviour/intentions measures tended to be stronger in samples with younger participants. Thus, young people may react more positively to interventions designed around identity variables. It might be beneficial to target young people also because any boosts in connectedness to nature, and possibly other identity variables, may last longer in this age group (Liefänder et al., 2013). At the same time, the moderator effects of age were reliable only for place identity / place attachment. Future research is warranted to test the stability of this finding.

The associations between social identity and behaviour and between connectedness to nature and behaviour were stronger for women, which makes them particularly suitable targets for interventions based on these identity variables. This finding is broadly consistent with previous research showing stronger ecological attitudes and behaviours in women (e.g., Fransson & Garling, 1999; see also Bloodhart & Swim, 2010, and Nurse, Benfield & Bell, 2010, for a more detailed analysis of gender differences and gender inequalities in relation to ecological behaviour).

Connectedness to nature was slightly more strongly related to pro-environmental behaviour in more individualistic countries. Moderation analyses with individualism-collectivism as the moderator were, however, limited by the fact that most observations came from relatively individualistic countries in Europe and North America.

Identities were, descriptively speaking, approximately equally strongly linked to behaviours and to intentions (with the exception of place identity, which was only linked to behaviour). This is interesting, as other psychological variables such as personal and social norms, attitudes, anticipated emotions, and values are typically more strongly related to intentions than to behaviours (Notani, 1998; Bamberg & Möser, 2007; Gardner & Abraham, 2008; Sandberg & Conner, 2008; Manning, 2009; Klöckner, 2013). This finding might be partly explained by the fact that some items measuring environmental identity inquire about specific behaviours (e.g., "I am the type of person who saves energy", van der Werff et al., 2013b). However, this explanation does not seem to apply to social identity and connectedness to nature. Thus, there might be something about the influence of identity that translates equally strongly into intentions and behaviours. Perhaps when it is one's identity that leads one to form an intention, he or she might be more firmly determined to follow through with implementing the intention, even when faced with factors acting against its implementation, such as difficulty, costliness or social norms (see Lapinski et al., 2017).

### **2.5.1 Limitations and directions for future research**

A number of potentially relevant articles met all inclusion criteria except for reporting correlations. We plan to contact the authors of these papers for a follow up study to obtain unreported data. Replications and meta-analyses are two cornerstones of establishing the robustness and practical significance of research findings (Maniadis et al., 2014). Complete reporting of information necessary for conducting meta-analyses should thus become a standard practice in the social sciences, as has been pointed out repeatedly (e.g. Karlin et al., 2015; Morren & Grinstein, 2016).

We only had a couple of observations where pro-environmental social identity served as the independent variable (Brunsting & Postmes, 2002; Bartels & Reinders, 2010, 2016; Dono et al., 2010; Bartels & Hoogendam, 2011; Bartels & Onwezen, 2014; Bamberg et al., 2015), which means the links between this subtype of social identity and

the outcome variables have not been estimated with much precision.<sup>15</sup> This also limited our ability to draw conclusions from the moderator analysis reported in section 2.3.1. More studies that focus on pro-environmental social identities are therefore needed. According to the present evidence, pro-environmental social identities might be particularly powerful drivers of pro-environmental action, both directly and possibly also by making adherence to pro-environmental social norms more attractive to high identifiers (Masson & Fritsche, 2014; Fritsche et al., 2017). Thus, it is highly desirable to more extensively investigate the variables that may moderate social identity effects. Of particular interest in this regard would be perceived environmental ingroup norms and collective efficacy which have been proposed to moderate the effects of social identity (Fritsche et al., in press). However, given the presumably low number of actual studies involving both ingroup identification and (at least) one of these moderator candidates, more experimental work is warranted before a meta-analytical approach will be promising.

## 2.6 Conclusion

In this report, we gathered and systematically examined available evidence on the statistical associations between pro-environmental behaviours and intentions on the one hand, and social identity, environmental identity, connectedness to nature and place identity on the other hand. Using quantitative meta-analytical methods, we confirmed that most of the associations between identity measures and outcome variables were positive and typically moderate in size.

Available evidence points to a robust positive role of environmental identity and connectedness to nature in promoting environmental behaviours and intentions. Connectedness to nature was slightly more strongly related to pro-environmental behaviours in female participants and in samples drawn from individualistic countries (e.g., The United States, United Kingdom and The Netherlands, see Hofstede et al., 2010).

The results with respect to the effects of place identity are mixed. Place identity was a moderately strong predictor of behaviour but it did not predict pro-environmental intentions. Interestingly, place identity had a positive influence especially on younger people.

The evidence suggests that pro-environmental social identity might potentially be the most powerful driver of pro-environmental action. However, it is too soon to draw definitive conclusions here, as there were only eight studies where pro-environmental social identity served as the predictor. It seems advisable to learn more about the conditions that determine direction and size of social identity effects on pro-environmental intentions. Given the low number of studies that are available today, specific experimental studies seem warranted that address these possible moderating factors, such as ingroup norms and collective efficacy beliefs (see Fritsche et al., in press; Masson & Fritsche, 2014).

To sum up, our findings confirm the substantial policy potential of all studied identity variables (with some mixed results occurring in case of place identity). The next two steps to garner the full potential of identity processes consist of conducting smaller-scale laboratory experiments, followed by scaled-up experiments in the field. Such an approach has been previously applied for example in the context of norm-based interventions promoting energy conservation (Schultz et al., 2007; Allcott, 2011).

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<sup>15</sup> Links with behaviour: Dono et al. (2010), Bartels & Hoogendam (2011), Bartels & Reinders (2010, 2016), links with intention: Brunsting et al. (2002), Bartels & Onwezen (2011), Bamberg et al. (2015).

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## **3 PSYCHOLOGICAL DETERMINANTS OF ENERGY SAVING BEHAVIOUR: AN INDIVIDUAL LEVEL META-ANALYSIS**

### **3.1 Summary of meta-analysis #2**

In our second meta-analysis, we conduct a series of five single meta-analyses, based on 102 independent samples taken from 67 published studies, with 59,948 participants, to evaluate the strength of the associations between five different classes of individual psychological determinants (namely, attitudes, intentions, values, awareness of consequences, and emotions) and energy-saving behavioural intention and actual behaviour. The results of the meta-analyses show a positive large association of energy-saving intention/behaviour with emotions; a positive moderate/large association of energy-saving intention/behaviour with attitude; a positive moderate association of energy-saving intention/behaviour with awareness of consequences/beliefs in climate change; a positive moderate association of energy-saving behaviour with intention to adopt energy saving solutions; a positive small/moderate association of energy-saving intention/behaviour with pro-environmental values. Moderation analyses show that the links between pro-environmental values and emotions to intention/behaviour are weaker among older people; the link between emotions and energy-saving behaviour is weaker among women; the link between intention and behaviour is stronger among students samples; the relationship between attitude and behaviour is not statistically significant when the outcome of the study is the actual behaviour (e.g., actual electricity consumption measured in kwh); the link between attitudes and intentions is stronger than the link between attitudes and self-reported behaviour.

### **3.2 Introduction to meta-analysis #2**

The role of behaviour change is crucial in creating opportunities to reduce energy use by individuals. According to Fishbein and Ajzen (1975, p. 13) a behaviour is an "observable act". Most of our daily household activities have the potential to accommodate energy saving behaviours. Such behaviours generally manifest themselves as individual investments either with long-term effects (e.g. purchasing an energy efficient fridge or installing new insulation) or in the repeated curtailment of energy consumption when a pro-environmental behaviour is adopted (such as switching off the lights at home or office) and when energy saving devices are used. Given the potential contribution of behaviour change to an overall reduction in energy use, it is definitely important to explore opportunities for maintaining, encouraging and motivating energy saving in our daily life. Researchers have generally adopted various terms to describe behaviours that indicate a care for the environment, such as environmentally concerned behaviours, environmentally responsible behaviours, pro-environmental behaviours, ecological behaviours, conservation behaviours, environmentally significant behaviour and many others (e.g., Lee et al., 2013). Pro-environmental behaviours is defined by Kollmuss & Agyeman (2002, p. 240) as "behavior that consciously seeks to minimize the negative impact of one's actions on the natural and built world". More specifically, Steg and colleagues (2014, p. 104) describe the pro-environmental behaviour as "any action that enhances the quality of the environment". Pro-environmental behaviours have been extensively studied in social sciences and, in particular, different theories of social psychology have explored the influence of different factors internal (e.g. norms, attitudes, motivations, values) as well as external to the individual (e.g. household income or socio- demographic characteristics) affecting it. According to several authors, (e.g., Homburg & Stolberg, 2006), examples of pro-environmental behaviour include environmental activism (e.g., active involvement in environmental organizations), non-activist behaviour in the public-sphere (e.g., petitioning on environmental issues), private sphere environmentalism (e.g., saving energy, purchasing recycled goods), and behaviour in organizations (e.g., product design).

Over several decades, environmental psychology and social psychology have investigated the link between pro-environmental behaviours and human energy consumptions. Several psychological models and theories have been developed to investigate the factors influencing the decision to engage in pro-environmental behaviours. Ajzen's (1991) theory of planned behaviour, Schwartz's (1977) norm activation model and Stern's (2000) Value-Belief-Norm Theory are the theoretical frameworks of most of the studies aimed to explain pro-environmental behaviours (e.g., Abrahamse & Steg, 2009). Similarly, social psychology brought a large contribution to the research on pro-

environmental behaviour providing numerous theoretical concepts and models used in the interventional studies based on feedback (Stern, 1992) considering both the individual and the group as unit of analysis.

In an effort to integrate key insights from the literature, the purpose of this meta-analysis is aimed to provide a comprehensive review of research on the individual-level predictors of energy saving behaviours, related to the three different ECHOES project's technology foci (e-mobility, e-buildings and smart technologies). Drawing on literature from a broad spectrum of studies across social and psychological sciences, we examine five categories of variables that have been identified as potentially important for explaining variability in energy saving behaviour, in terms of private sphere environmentalism.

### **3.2.1 Environmental attitudes**

Attitudes have been considered one of the essential variables explaining a broad range of human deliberate behaviour and intentions (Ajzen & Fishbein, 1980), including pro-environmental ones. An attitude is "a relatively enduring organization of beliefs, feelings, and behavioural tendencies towards socially significant objects, groups, events or symbols" (Hogg & Vaughan 2005, p. 150). In the field of social psychology, attitude has been treated as one of the most important concepts for understanding social interaction, and it can be explained as the positive or negative evaluation that is given to an hypothetical behaviour, depending on the reasoned weighting of expected costs and benefits implied by that certain course of action (Ajzen, 1991). Before an individual decides to take or not to take an action, the action is evaluated in terms of favourable or unfavourable behaviour. Behaviours that are supposed to have desirable outcomes make positive attitudes, and likewise, behaviours that are believed to have undesirable consequences often form adverse attitudes. People's attitudes towards the environment have become a significant focus of interest for many environment-related studies across a range of social psychology disciplines. A variety of terminologies has been used by researchers to describe people's beliefs, feelings and intentions towards the environment. In this context, the terms "environmental attitude" and "environmental concern" appear to be the most commonly used in the social psychology literature (Milfont, 2007). The two terminologies have been considered one and the same in certain cases and they have also been differentiated in other circumstances. Some researchers pointed up differences between the two terminologies, locating "environmental attitude" within attitude theory and defining "environmental concern" as people's concern or worry about environmental issues and problems. For example, Schultz et al. (2004) described the environmental attitude in terms of "beliefs, affect, and behavioural intentions a person holds regarding environmentally related activities or issues". More recently, Milfont and Duckitt (2010, p. 80) defined environmental attitude as "a psychological tendency expressed by evaluating the natural environment with some degree of favour or disfavour". Other researchers such as Dunlap and Jones (2002) and Huddart-Kennedy et al. (2009a) used the term of environmental concern in terms of "degree to which people are aware of problems regarding the environment and support efforts to solve them and/or indicate a willingness to contribute personally to their solution." Reviews of research in this field reveal that environmental attitudes have been widely considered as powerful predictors of pro-environmental behaviours (Gifford & Sussman, 2012). For purposes of conceptual clarity, the term "environmental attitude" is used in this meta-analysis.

In the energy-related behavioural domain, personal beliefs on a given behaviour to adopt, whether it is good or bad, favourable or unfavourable, and valuable or worthless is reflected on the attitude towards the energy-related behaviour. The main reason for studying environmental attitudes in the field of energy saving behaviour is related to the well-known link between attitude and behaviour in social psychology. Positive attitudes towards a specific environmental issue (e.g. climate change) were found to be associated to behavioural intention in that same domain (e.g., Poortinga, Steg & Vlek, 2004). Different theories have been models to explain the attitude-behaviour links, and the circumstances under which this link occurs, both in general (Manstead; 1996) and in the environmental domain in particular (Staats, 2003).

The most common theoretical model that has been used in the last three decades is the Theory of Planned Behavior (TPB; Ajzen, 1991). The TPB framework adopts a rational decision-making framework (Turuga, Howarth and Borsuk, 2010). The premise of TPB is that human behaviour is a continual process of making deliberate choices between distinct courses of action. In brief, the TPB has developed as an extension of Ajzen and Fishbein's (1980)

theory of reasoned action (TRA). Both models have the common objective of predicting behaviours from attitudes as well as to explain the process through which the two factors are related, focusing on the importance of the intention of performing a particular behaviour as a key mediator between attitudes and behaviours. The TRA proposed that an intention to adopt a behaviour is determined by the attitude toward a given behaviour and the personal subjective norms. The addition of a variable related to the perceptions of control over behaviours, called perceived behavioural control, served to extend the TRA into the TPB (Ajzen 1991). Several studies have showed the theory's value in predicting pro-environmental behaviours and in highlighting significant barriers and drivers underlying intention formation and behavioural change in the field of energy conservation (Bamberg and Moser, 2007). One of the main advantages of the TPB for analysing and predicting energy saving behaviours consist in its capability to consider a large set of complex determinants in a reasonably simple structure. In the specific energy-related domain, the TPB framework has been applied to analyse both individual's energy saving behaviours as well as the acceptance of renewable energy technologies (Abrahamse and Steg, 2011; Wang et al., 2011; Kano, 2013; Alam and Rashid, 2012; Perri and Corvello, 2015). Studies in this field report a positive association between attitudes towards electric cars and different adoption indicators (Degirmenci and Breitner, 2017; Nayum and Klöckner, 2014; Moons and de Pelsmacker, 2012; Barbarossa et al., 2015). Kranz and Picot (2011) investigated the factors influencing consumers' intention to adopt the smart meter technology. Also in these cases, results revealed that attitude is the most influential determinant of intentions.

Despite the theoretical assumptions described so far and the empirical evidence available, it is useful to underline that in the face of numerous studies that suggest a strong association between attitude and behaviour, other research findings highlight the poor predictability of behaviour from attitudes; this inconsistency has also been called the attitude-behaviour gap (Gifford & Sussman, 2012). A possible explanation of this discrepancy lies in the choice of the methods of collecting data related to behaviour. The most common method in social research is self-reported behaviour, through questionnaires and other measures that frequently do not reflect the actual adoption of a behaviour and can be subject to a social desirability bias (Gifford & Sussman, 2012). In addition, the attitude-behaviour association appears to be stronger when multiple measures are employed, rather than when a behavioural measure consisting of a single behaviour is used (Fishbein & Ajzen, 1974). Finally, high correlations between attitude and behaviour can be obtained when the level of specificity of attitudes and behaviours are compatible each other (Ajzen, 1988). That is to say, specific attitudes tend to be good predictors of specific behaviours.

In sum, the TPB is one of the most widely known and applied models to explain humans' energy pro-environmental behaviour through a cognitive approach, centred on individuals' cognitive deliberate and aware processes, such as their attitudes and beliefs towards a given behaviour. Environmental attitudes are certainly among the main factors that can be focused on if we want to change human behaviour in the energy domain. Nevertheless, it is important to consider also additional factors that can affect human behaviour, both directly as well as strengthening the association between attitudes and the actual adoption of energy saving behaviours.

### **3.2.2 Intention to perform an energy saving behaviour**

Similarly to the role of environmental attitudes, a person's intention to perform (or not to perform) a behaviour has been considered by many authors as the most important and immediate determinant of that action. Intention serves as a presupposition of favourable energy saving choices and encompasses the likelihood of specific course of action, such as for example purchasing a particular energy-efficient product or adopting specific energy saving solutions as a result of environmental needs. Purchasing intention refers to the readiness of person to buy a preferred product. Preferences are formed after an evaluation process that is the product of factors such as personal experiences, attitudes or subjective norms in relation to that specific product (Hai, Moula, & Seppälä, 2017).

In the environmental psychological literature, the term "green purchasing" is also used to indicate consumers' willingness to purchase of environmentally friendly products that comply with consumers' needs without damaging the environment (Joshi and Rahman, 2015; Chan, 2001). Motivational factors that influence consumers' green

purchase behaviour can be linked to intentions (Ramayah, Lee, & Mohamad, 2010). Green purchase behaviour is the result of a complex form of decision-making behaviour. A study in China confirmed a strong positive relationship between purchase intention and actual green purchase (Chan & Lau, 2000). Stern (2000) described two categories of pro-green purchase behaviour, which could be relevant in the energy domain: purchasing practices that are concerned about the environmental impact of future production and energy demands (e.g. organic food or recycling products) and purchasing practices related to household goods and services, such as energy efficient domestic appliances. Many studies explained the association between intention and green purchase behaviour focusing on the role of underlying values, attitude and behavioural intentions toward environmentally friendly products (e.g., Vermeir & Verbeke, 2006; Wheale & Hinton, 2007). Energy intentions were also seen to have a moderate positive association with energy efficiency behaviours (e.g., Zierler, Wehrmeyer and Murphy, 2017). Afroz and colleagues (2015) found that purchase intention has an influence on purchase behaviour toward environmentally friendly vehicles. A medium effect of behavioural intention was found on purchase decision in relation to LED technology adoption, in a study by Khorasanizadeh and colleagues (2016). Specifically, their results indicated that behavioural intention acts as a mediator between social influence factors and LED purchasing decision.

Just as for environmental attitudes, the theory of reasoned action (TRA) by Ajzen and Fishbein (1980) and the theory of planned behaviour (TPB) by Ajzen (1991) have been the two prominent theoretical approaches adopted by most of the literature in this field. Based on the theoretical frameworks mentioned, behavioural intention is an indicator of the extent to which people are willing to try or how much an effort they are planning to exert in order to perform a certain behaviour. Consequently, behavioural intention is assumed to mediate the motivational factors that influence a behaviour such as attitude, subjective norm and perceived behavioural control (Ajzen, 1991). Behavioural intention is also assumed to be the immediate antecedent of behaviour (Ajzen, 2002). However, this does not mean that intentions always predict behaviours. According to Devinney and colleagues (2010), "intention does not imply a true assessment of what will occur, but a statement by the individual that gives his/her revealed stated reaction to something in such-and-such circumstances" (p. 51). Frederiks and colleagues (2015) argued that a sizeable discrepancy can often be observed between intention and behaviour.

Different intervening factors have been shown to affect the implementation of intentions such as the perceived behavioural control (Armitage & Conner, 2001) and the temporal stability of intentions (Conner & Godin, 2007; Conner, Sheeran, Norman, & Armitage, 2000). Perceived behavioural control is the estimated personal capability to execute the set of actions required to achieve a goal, under a specific circumstances (Rodgers, Conner, & Murray, 2008). As assumed by the TPB, a behaviour can be predicted by both the intention to perform it and the perception that the behaviour falls within a likely range of personal possibilities (Armitage & Conner, 2001). The concept of perceived behavioural control is very similar to perceived self-efficacy, a concept that refers to the beliefs over the personal ability to plan and execute the actions required to achieve a certain goal. This is not determined by the objective skills a person has, but rather by their estimate or perceptions about what they will be able to do under an expected range or circumstances (Bandura, 1997). Especially when effort plays a key role in the reasoned weighting of cost and benefits, the person is likely to have independent levels of perceived behavioural control over the possibility to perform or not perform an intended behaviour. Then this will influence both the intention to perform a behaviour and the probability to produce it (Richetin, Conner, & Perugini, 2011). In addition, an intention has to remain reasonably stable over time in order to predict a behaviour (Ajzen, 1996). In fact, when intentions are evaluated before the behaviour, these can latter change in response to events occurred meanwhile, thus turning the direction of the behavioural intention. Temporal stability of intentions can be considered a key indicator of intention strength (Sheeran & Abraham, 2003).

The mismatch between intentions and behaviour results in intentions-action gap. A meta-analysis conducted more than a decade ago (Sheeran, 2002) showed that intentions explain only about the 28% of the variance in actual behaviour. However, another meta-analysis by Webb and colleagues (2006) found a weak support for the impact of changing behavioural intentions on consequent change in behaviour. Results showed that a medium-to-large sized change in intention leads to only a small-to-medium change in behaviour. These results confirm the plausibility of intention-action gaps, because simply possessing these intentions does not automatically translate to behaviour. However, they are also indicating that people can be driven by certain intentions and be more inclined to engage



in energy-saving behaviour. Thus, it is worthy to include intentions in our meta-analysis as a factor to be estimated as a potentially relevant predictor of energy-related choices.

### 3.2.3 Environmental values

Values are frequently discussed with respect to environmental issues. Changes in values can lead to more sustainable behaviours (Dietz, Fitzgerald, & Shwom, 2005). Humans rely on values as life guiding principles in their lives, “to select and justify actions and to evaluate people (including the self) and events” (Schwartz, 1992, p. 1). Values are also often conceived cognitive representations of abstract goals or abstract means of behaving linked to affects and emotional states. Values vary in desirability or importance at the individual level, and that makes them a relevant source of variation across individuals, groups and communities. They also function as motivational constructs that guide a person’s behaviour, but unlike specific goals and desires, they usually transcend situations (Schwartz, 1992). Values differ from attitudes in that attitudes are positive or negative evaluations of rather specific issues, while values tend to be more general indicators of people’s stances towards broad life circumstances, events or ideologies. In addition, contrary to norms and attitudes that can change over time, values tend to remain more stable over the adult life of a person. Based on such premises, it is easy to understand that the role of human values in pro-environmental behaviours has been often deemed as fundamental. If some values can hinder pro-environmental actions, other values can encourage the adoption of more sustainable ones (Steg and de Groot, 2012).

The values-beliefs-norms theory (VBN; Stern 1999a; 2000) emphasizes the indirect association between values and decisions about the environment. Based on the Stern’s theory, values influence personal worldviews about the environment, which in turn affect individuals’ beliefs about the consequences of environmental change, which in turn have an effect on the personal perceptions of one’s own ability to reduce environmental risks. This, in turn influences personal norms about taking actions. The framework summarizes the fundamental determinants of environmental concern in three categories of values, namely biospheric, altruistic, and egoistic values (e.g. Milfont, Duckitt & Cameron, 2006; Schultz et al., 2005; Stern, 2000). People endorsing a biospheric value orientation assess environmental issues on the basis of costs or benefits to ecosystems, people with an altruistic orientation evaluate environmental issues on the basis of costs and benefits to other people or to humanity as a group, and people with an egoistic orientation judge environmental issues on the basis of costs or benefits to themselves (Naess, 2003; Milfont et al., 2006). A large number of studies has shown consistently strong associations between pro-environmental behaviour and a biospheric value orientation (Schultz, 2004; Milfont, Duckitt, and Cameron., 2006; Deng, Walker & Swinnerton, 2006). Studies in this field have also examined the role of values, attitudes and beliefs in the context of more specific energy related behaviours such as, for example, residential energy usage (Abrahamse & Steg, 2009; 2011; Schultz, 2000; Schultz, 2003). Thus, in our meta-analysis, the role of biospheric values on the energy saving behaviour is considered.

In recent years, various studies (de Groot & Steg, 2008; Collins, Steg & Koning, 2007; Poortinga, Steg & Vlek, 2004) used Schwartz’s model of human values to classify and assess values. The model presents ten types of universal values that were then clustered into four groups: 1) openness to change, 2) conservatism, 3) self-transcendence (altruism), and 4) self-enhancement. Altruistic or self-transcendent values were found to have a positive effect on personal norms to behave pro-environmentally, and also directly on pro environmental actions (de Groot & Steg, 2008; Stern et al., 1999; Wall et al., 2007). Of particular importance for the present meta-analysis are the self-transcendence value orientations, since previous studies have linked these value orientations to pro-environmental attitudes and behaviours (Nordlund & Garvill, 2002; Collins, Steg & Koning, 2007; Thøgersen & Ölander, 2003; Stern, 2000, Schultz et al., 2005). Self-transcendence is a social-altruistic value orientation that include two value types, universalism (improving the welfare of all people) and benevolence (welfare of close others). One of the most widely cited works about values and environmental outcomes (Schultz et al., 2005) was conducted a study among six different cultures, involving around 720 participants. The researchers assessed how Schwartz’s values, specifically self-transcendent and self-enhancement values, predict concern for environmental problems and general pro-environmental behaviour. This study found that self-transcendent values are positively related to environmental concern, while self-enhancement are negatively related to general concern, with a generalised pattern across the different countries considered in the study.

In sum, it is important to take into account that, as for environmental attitudes, values are most commonly related to either self-reported behaviours or behavioural intentions. However, also in terms of environmental values, it is necessary to take into account that a “value-action gap” has been observed across many domains of human behaviour (Boulstridge & Carrigan, 2000; Flynn, Bellaby & Ricci, 2010; Huddart-Kennedy et al., 2009b). As for the already mentioned “attitude-action gap” and “intention-action gap”, daily life presents many situations where people express tough beliefs or strong values about the need of contrasting the negative consequences of environmental problems (e.g., global warming, climate change), as well as positive evaluations of energy saving solutions and “low carbon” technologies (e.g., renewable energy sources), but fail to translate those beliefs, values and attitudes into practical actions to reduce household energy use.

### **3.2.4 Awareness of consequences and climate change beliefs**

People’s direct knowledge about environmental issues is usually limited. Typically, the environment and its problems are often under-noticed or perceived as separate from people’s daily life, until they start to directly impact people’s conscious experience. According to Partanen-Hertell and colleagues (1999), “high level of awareness enables individuals to make conscious choices for acting in an environmentally friendly way” (p. 9). In their work, these authors claim that environmental awareness follows a stage development process. Specifically, environmental awareness begins to develop when people start to notice adverse, threatening changes in their surroundings. This consciousness raising stimulates increasing levels of knowledge and skills that usually are based on a growing concern over threats to personal health. Subsequently, when people realize that they can influence the state of the environment, their feelings of responsibility and their motivation to take action rises. Due to the fact that a sense of responsibility and motivation toward the environmental issues increase, people recognize that the development of a welfare and healthy society also depends on the state of the environment. Therefore, environmental problems start to be perceived globally and the need to support other countries in environmental activities starts to be considered as essential. Environmental friendly actions are seen as normal parts of everyday life, both in private and in work settings. At the end of its development, the environmental awareness becomes an integral part of professional skills and people’s everyday life choices (Partanen-Hertell et al., 1999; Harju-Autti & Kokkinen, 2014).

Environmental awareness has also been defined in terms of environmental knowledge and/or recognition of environmental problems (Grob, 1995). In our meta-analysis, we refer to those environmental problems that derive from the effects of global climate change and to public’s awareness of adverse consequences of environmental problems. There has been growing interest about climate change issues among environmental researchers. The main reason is related to the potential extremely adverse consequences that climate change is having and will continue to have on the environment and on human life on the entire planet. Solutions to the harmful effects of climate change include individual and household behavioural changes in the domain of energy consumption, community involvement and participation, organizational policies development and reinforcement as well as governmental mobilization and intergovernmental partnerships (e.g., Swim, Markowitz, and Bloodhart, 2012).

The awareness of consequences (or increasing knowledge) is also an important factor put forward by the above-mentioned Value–Belief–Norm theory from Stern (VBN; Stern, 2000) and by Schwartz’s Norm Activation model (NAM; Schwartz, 1977), which both try to explain why people adopt pro-environmental behaviour (Jackson, 2005). According to Hansla et al. (2008), the determinants of intentions in the VBN theory to perform pro-environmental behaviours include awareness of consequences – defined as individuals’ beliefs about the adverse consequences of environmental problems. Likewise, the NAM assumes that a personal norm to perform a pro-environmental behaviour is activated by the awareness of consequences of one’s actions and the ascription of personal responsibility for them. Schwartz’s model describes awareness of consequences as the extent that people take into account negative impacts of their behaviours on the welfare of others or on the environment, when making decisions. Ascription of Responsibility refers to feelings of accountability for the consequences caused by one’s own actions.

Recent studies have found an increase in the public awareness of adverse consequences of climate change (Ockwell, Whitmarsh & O'Neill 2009; Steg, 2008). A 2009 survey of the Department for Environment, Food and Rural Affairs and (DEFRA 2009; Thornton 2009), found the majority of their respondents claimed that they were trying to cut down on the use of gas and electricity at home in response to the threats of climate change. Indeed, the awareness of consequences have been shown to increase the intention to adopt an electric vehicle (Bockarjova & Steg, 2014), and to curtail energy consumption (Van der Werff & Steg, 2015). Similarly, people with higher awareness of consequences were more likely to adopt an electric car, rather than combustion engine cars (Nayum, Klöckner & Mehmetoglu, 2016). In their meta-analysis, Bamberg & Möser (2007) showed that awareness is an important but indirect determinant pro-environmental behavioural intentions.

### **3.2.5 Emotions as drivers of energy saving behaviour**

Emotions have a crucial role in motivating human behaviour (Damasio, 1994; LeDoux, 2012; Levine & Leven, 2014). Based on this assumption, emotions can be considered as important triggers of a variety of social behaviours, including pro-environmental or energy-related ones (Carrus, Passafaro & Bonnes, 2008; Ferguson & Branscombe, 2010; Halpenny, 2010; Harth, Leach, & Kessler, 2013; Hine, Marks, Nachreiner, Gifford, & Heath, 2007; Koenig-Lewis, Palmer, Dermody, & Urbye, 2014; Onwezen, Antonides, & Bartels, 2013; Rees, Klug, & Bamberg, 2015). Despite the recent flourishing of the interest for the role of emotions in human affairs in psychology and neuroscience, however, the relationships between emotions and pro-environmental behaviour in everyday life have received so far limited attention in research aiming at understanding the antecedents of pro-environmental behaviour (e.g., Carrus et al., 2008).

Previous research on relationships between emotions and pro-environmental behaviour has focused on particular type of emotional factors, which might be directly related to direct experience of the natural environment or to the adoption of specific pro-environmental behaviours (e.g., Ojala, 2008). Another line of research shows that people's negative anticipated emotions (e.g., anger, frustration, sadness) about engaging in pro-environmental behaviour (for example in the area of transport modes choice - public versus private- or waste recycling) reduced their desire to engage in these pro environmental behaviours (Carrus et al., 2008). Positive anticipated emotions (e.g., feeling happy and satisfied) and negative anticipated emotions (e.g., feeling disappointed and frustrated) regarding cycling have been shown to increase and decrease, respectively, desire to cycle as a form of transportation (Passafaro et al., 2014). These studies have indicated a clear link between emotions that are felt in relation to the environment and willingness to engage in pro-environmental behaviours (i.e., integral or task-related emotions; Cavanaugh, Bettman, Luce, & Payne, 2007). In this respect, the emotion-as-feedback theory proposes that anticipated emotion can be a direct cause of human behaviour (e.g., DeWall, Baumeister, Chester & Bushman, 2015; Mellers & McGraw, 2001). DeWall et al. (2015) have highlighted that an emotional state is used as information when one is deciding to act. That is to say, an individual's ability to appraise a future emotional state (e.g., anticipated emotion) enables to elaborate and to assess the value of the potential outcomes of one's own behaviour (Panno, Donati, Chiesi, & Primi, 2015).

Data from studies in this field propose an association between anticipated emotions and behaviour in the environmental domain, focusing on two specific types of discrete emotions: feelings of guilt and pride. These emotions are highly relevant to pro-environmental motivations, as both pride and guilt orient individuals to social concerns (Schneider et al., 2017) and moral considerations (Nelissen et al., 2011; Steenhaut and Kenhove 2006). Bamberg and Möser's (2007) meta-analysis of the determinants of pro-environmental behaviour describes the self-regulatory role that guilt may play in the interaction between cognitive factors (e.g., problem awareness, internal attribution), social and moral norms, attitudes and perceived behavioural control when one is deciding to act in an sustainable way. Several studies have shown a positive relationship between guilt feelings and pro-environmental action. Kaiser (2006) showed that anticipated guilt about not engaging in pro-environmental behaviour predicted intentions to engage in paper recycling. A similar relationship between anticipated guilt and pro-environmental behaviour associate to recycling patterns was also showed in a study by Elgaaied (2015). A positive main effect of a guilt induction (compared with no emotional induction) emerged in an analysis focused on the relationship between incidental guilt and support for climate change policy (Lu & Schuldt, 2015). In an experimental study, Schneider and colleagues (2017) examined the causal effects of anticipated pride versus guilt on pro-environmental



decision making and behavioural intentions, inducing these anticipated emotions just prior to asking participants to make a series of environmental decisions. Results showed that stimulating people to anticipate feelings of pride for positive future pro-environmental actions seems to have a more significant effect compared to prompting feelings of guilt for inactions.

Positive emotions may thus encourage pro-environmental action. Although previous research indicates the benefits of associating positive emotional experiences with pro-environmental actions (Carrus et al., 2008; Vining and Ebreo, 2003) there is still not much empirical data examining whether a causal or correlational link actually exists between positive affects and ecological behaviours. In two studies, Onwezen and colleagues tried to identify a positive relationship between positive emotions and pro-environmental behaviour (Onwezen, Antonides and Bartels, 2013; Onwezen, Bartels and Antonides, 2014). Results from a sample of Dutch respondents suggest that anticipated pride emotions mediated the effects of normative attitudes concerning environmentally friendly behaviours on pro-environmental behavioural intentions, such as intentions to purchase environmentally friendly products (Onwezen, Antonides and Bartels, 2013).

Research on the relationships between emotions and pro environmental behaviour in everyday life situations has therefore the potential to contribute to theories of pro-environmental behaviour by demonstrating the role of emotion as a predictor variable — and to help us in defining strategies about how pro environmental behaviour may be more successfully encouraged in many environmental behavioural domains, including energy-related ones.

### **3.3 Method**

#### **3.3.1 Literature search and selection of studies**

##### **3.3.1.1 Search strategy and inclusion criteria**

The calculations in this report are based on previously published data. We completed the literature search on June 20<sup>th</sup>, 2017. Various criteria were applied to select data for inclusion in the analysis. Specifically, studies were included in the meta-analysis if: (1) they were published in a peer-reviewed journal article in the last ten years; (2) they were published in English language; (3) the dependent variable has to be an energy-saving behaviour (actual or self-reported) or an energy-saving behavioural intention. (4) Among the independent variables has to be at least one of the following: attitudes, intentions, pro-environmental values, awareness of consequences, emotions (intentions were considered as predictors only for studies where the criterion variable was behaviour); (5) in case of researches using an experimental design, the studies were included only if the experimental design had a control group; (6) In the case of papers where bivariate correlations between the respective dependent and independent variables and the sample size were not reported, we contacted authors to have the data via email; in case of no response after 2 email remainders, the correlations were estimated starting from other data available in the paper whenever possible (e.g., regression coefficients). When estimation was not possible, the paper was not included in the analysis.

In addition, to excluding studies that did not meet the inclusion criteria cited above, we also excluded those studies that, rather than on energy use and consumption, were focused more on ideological, political or social stances that individuals, groups and communities might have in regard to energy-related issues; in this category, there are for example many studies that investigate people reactions to nuclear energy policies, or people aesthetic judgements or attitudes towards wind turbines, power lines, and so forth: these kind of studies were not included in our meta-analysis. Finally, qualitative studies that did not provide sufficient statistical data to allow the calculation of an effect size were not considered.

Note that, technically, we conducted five separate meta-analyses between variable pairs. The above-mentioned inclusion criteria were used to select the entire dataset for these analyses.

The search strategy followed to identify and select the studies to be included in the analysis was the following: studies were firstly identified by searching electronic databases (Scopus and Science Direct) and the reference lists from relevant articles. We used the following search terms for the meta-analysis:

“(attitude and energ\*) or (attitude and electric\*) or (emotion\* and energ\*) or (emotion\* and electric\*) or (guilt and energ\*) or (guilt and electric\*) or (pride and energ\*) or (pride and electric\*) or (anger and energ\*) or (anger and electric\*) or (“belief\* in climate change” and energ\*) or (“belief\* in climate change” and electric\*) or (“belief\* in global climate change” and energ\*) or (“belief\* in global climate change” and electric\*) or (“belief\* in global warming” and energ\*) or (“belief\* in global warming” and electric\*) or (“belief\* of climate change” and energ\*) or (“belief\* of climate change” and electric\*) or (“belief\* of global climate change” and energ\*) or (“belief\* of global climate change” and electric\*) or (“belief\* of global warming” and energ\*) or (“belief\* of global warming” and electric\*) or (“belief\* about climate change” and energ\*) or (“belief\* about climate change” and electric\*) or (“belief\* about global climate change” and energ\*) or (“belief\* about global climate change” and electric\*) or (“belief\* about global warming” and energ\*) or (“belief\* about global warming” and electric\*) or (“climate change risk perception\*” and energ\*) or (“climate change risk perception\*” and electric\*) or (“perception\* of climate change ” and energ\*) or (“perception\* of climate change ” and electric\*) or (“climate change perception\*” and energ\*) or (“climate change perception\*” and electric\*) or (“knowledge in climate change” and energ\*) or (“knowledge in climate change” and electric\*) or (“knowledge in global climate change” and energ\*) or (“knowledge in global climate change” and electric\*) or (“knowledge in global warming” and energ\*) or (“knowledge in global warming” and electric\*) or (“knowledge about climate change” and energ\*) or (“knowledge about climate change” and electric\*) or (“knowledge about global climate change” and energ\*) or (“knowledge about global climate change” and electric\*) or (“knowledge about global warming” and energ\*) or (“knowledge about global warming” and electric\*) or (awareness and energ\*) or (awareness and electric\*) or (intention\* and energ\*) or (intention\* and electric\*) or (“environment\* value\*” and energ\*) or (“environment\* value\*” and electric\*) or (“value system\*” and energ\*) or (“value system\*” and electric\*)”.

Our search strategy found a set of 5802 potentially relevant articles. This number includes duplicate hits (e.g., when the same paper was located in both databases). After removing the duplicates, in the initial screening of the articles, we examined the abstracts of potentially relevant papers to determine whether they met our inclusion criteria or they fell in our exclusion criteria. Thus, a sample of 582 full-text research articles remained to be inspected. Based on this set, we eliminated entries that were inconsistent with our eligibility criteria and those papers that shared the same dataset of a study already selected for the MA, such as multiple analyses conducted with an identical dataset on an identical variable pair ( $K = 480$ ). Finally, we contacted authors for additional data where whose articles were published within the last ten years that did not include sufficient information for us to compute the effect sizes. A final set of 102 research articles was included in the current meta-analysis after the application of all the inclusion criteria.

### 3.3.2 Coding procedures

**A final set of 102 Each study was coded for the following characteristics:**

- Sample size
- Mean age in the sample
- Gender: Percentage of women in the sample
- Type of sample: 1 = student sample, 2 = non-student sample, 3 = representative sample
- Technological focus: 1 = smart energy technology, 2 = electric mobility, 3 = energy in buildings.

In addition to this general coding, other more specific coding was applied. With regard to the dependent variable (i.e., intention to adopt energy saving solutions, self-reported behaviour and actual behaviour, such as, for example, electric consumption measured through kwh) we often found research articles that reported two or more of these measures. Thus, as a strategy, we chose as dependent variable of our interest the more conservative or “objective”

among the measures included in a given study. For example, if a study included all of these three different outcomes (intentions, self-reported behaviour, actual behaviour), to calculate the Effect Size we chose the actual behaviour outcome. If we found two of these three outcomes (e.g., intention to adopt and self-reported behaviour), we then chose the self-reported behaviour outcome. If the primary study reported both self-reported and actual behaviour, we then chose the actual behaviour. In other words, the more objective outcome available in each study has been selected for the MA. Such a strategy allowed us to reduce the number of studies reporting multiple non-independent effect sizes that could affect the final estimates in the current meta-analysis. Nonetheless, as shown in the next section, we carried out a sensitivity analysis when it was not possible to choose a single measure of these, because the primary study reported, for example, two separate measures of self-reported behaviour (e.g., I rent an EV to circulate around the city and I purchased an e-bike). Thus, we coded as “1” the studies reporting only intentions to adopt energy saving solutions, as “2” the studies on self-reported energy-saving behaviour and as “3” the studies reporting energy-saving actual behaviour (see type of dependent variables as a factor in the moderation analyses in the following paragraphs).

With regard to the type of study, we included in the meta-analysis both cross-sectional and longitudinal studies, if there was no intervention among the waves of the longitudinal studies. In the case of experimental studies, or studies involving interventions we then collected the correlation at the baseline before the intervention or in the control group condition, thus experimental manipulations or interventions could not affect the final estimate of ES in the current meta-analysis. Overall, the majority of studies reviewed and include in our MA were cross-sectional, with a very small number of laboratory or field experimental studies. In addition, experimental and field studies reported very different kinds of interventions or manipulations, we therefore decided to include only correlations reflecting cross-sectional studies or specific sub-samples such as control group condition or baseline. As shown in the next section, to carry out a sensitivity analysis we coded differently studies where effect sizes are derived from multivariate (e.g., multiple regressions) or from univariate analyses (e.g., Pearson’s correlations). This strategy allowed us to broaden the number of studies that we included in the final meta-analysis, especially for what it concerns those predictors that are generally less investigated in the current literature. As a rule, we always contacted authors of a given article to have the actual  $r$  and  $N$  values. In cases where no response was obtained, then we used coefficients from multivariate analyses, such as regression coefficients, that were adjusted through the Peterson and Brown’s (2005) formula to estimate an  $r$  value (see below for more details about this formula). Thus, we coded as “1” studies that provided  $r$  values directly from univariate analyses and as “2” studies that employed multivariate analyses providing other values that needed to be adjusted through the Peterson and Brown’s (2005) formula. In the case of studies reporting multiple non-independent effect sizes, we coded as 1 such studies and as 2 studies having independent effect sizes. Finally, concerning the predictor labelled “awareness of consequences/beliefs in climate change”, we coded the studies referring to awareness of consequences measures as “1” and the studies referring to beliefs in climate change measures as “2” (see the sensitivity analysis sections for more details about this point).

### 3.3.3 Sensitivity analysis

Because in some cases the data for the calculation of effect sizes were derived from multivariate analyses (multiple regressions, path models, SEM, etc.), the effect sizes based on  $r$  values maybe over - or under- estimated. Therefore, we explored, through a sensitivity analysis, if the effect size estimates vary as a function of effect sizes that are zero-order (i.e. derived from univariate analyses) or derived from partial coefficients (see the following section for more details). A sensitivity analysis has also been carried out to highlight any eventual difference between studies reporting and not-reporting multiple non-independent effect sizes (see the sensitivity analysis results section for more details). Finally, a sensitivity analysis has been carried out to investigate potential differences between studies that use a general measure of awareness of consequences and studies that focus on specific measures of beliefs in climate change (see results section for more details).

### 3.3.4 Statistical analyses

We used the correlation  $r$  as the effect size metric for the current meta-analysis. For studies that only reported the  $\beta$ s we had applied Peterson and Brown's (2005) formula:  $r = \beta + 0.05 \lambda$  (where  $\lambda = 1$  for non-negative  $\beta$ s, and  $\lambda = 0$  for negative  $\beta$ s) in imputing the corresponding  $r$ s. We also computed  $r$  values for studies that did not conduct correlational analyses via sample sizes along with  $t$ -values,  $\chi^2$  values,  $p$ -values, and standardized mean differences (i.e., Cohen's  $d$ ). In addition, we reverse-scored several measurements to assure that each positive effect size computed would represent a direct positive association between the various predictors (attitude/awareness of consequences/beliefs in climate change/emotions/pro-environmental values/intentions) and energy saving behaviour (ESB).

We adopted a random-effects model to calculate the combined effect size of each predictor on ESB. Because our sample contained studies conducted with noticeably different features, we did not follow the fixed-effect model. In fact, the latter model assumes that all the studies included are functionally identical and share a single canonical effect size (Borenstein, Hedges, Higgins, & Rothstein, 2010; Hedges & Vevea, 1998). Additionally to relaxing this assumption, the random-effects model allows for more unconditional inferences (i.e., a generalizable conclusion to situations beyond the sampled studies) of the results (Field, 2001).

Even though it was not very frequent, sometimes we found studies reporting non-independent effect sizes (e.g., multiple measures of the same variable). In these cases, we computed effect sizes using Cooper's (1998) Shifting-Unit-of-Analysis method for studies that report multiple, non-independent effect sizes. As such, we referred to the study as the unit of analysis meaning that each study included would contribute only to one summary effect size to the main analysis (see Cooper, 1998; see also the sensitivity analysis paragraph for more details about this point).

We display the 95% confidence intervals alongside certain indices of heterogeneity assessment like  $I^2$ , i.e. the cross-studies 'inconsistency index' (Higgins & Thompson, 2002; Higgins, Thompson, Deeks, & Altman, 2003), Cochran  $Q$ , and tau-squared (the 'study-to-study variances') (Borenstein et al., 2009).

We also addressed the issue of publication bias via examining the funnel plots, where all effect sizes are plotted against the standard error. To empirically evaluate the extent of the symmetry of the funnel plot, and hence the severity of potential publication bias we examined the classical Rosenthal's (1979) fail-safe  $N$ .

We applied the mixed-effects model in the categorical univariate moderator analyses and the meta-regression analyses for the continuous moderators. All analyses in the current meta-analysis were conducted using the Comprehensive Meta-Analysis (CMA) software, Version 3.0 (Borenstein et al., 2009; Borenstein, Hedges, Higgins, & Rothstein, 2014).

## 3.4 Results

### 3.4.1 Sensitivity analysis results

In the current meta-analysis, the sensitivity analysis aimed to explore if the effect size estimates vary as a function of the fact that effect sizes are derived from univariate analyses (i.e., zero-order) or derived from multivariate analyses (i.e., partial coefficients). Results did not show differences among these sub-groups of studies across each predictor (all  $p$ s = ns). The sensitivity analysis also aimed to explore potential differences between studies reporting and not-reporting multiple non-independent effect sizes. Results did not show differences among these sub-groups of studies across each predictor (all  $p$ s = ns). Results of the sensitivity analysis concerning with differences between the measures of awareness of ecological consequences and beliefs in climate change are reported in the next section (i.e., Overall, moderator and publication bias results section).

### 3.4.2 Attitude and energy saving Intention/Behaviour

#### 3.4.2.1 Overall and publication bias results

The list of effect sizes of the association between attitude and energy saving intention or behaviour (ESIB) are contained in Table 3.1. The analysis revealed a moderate/large positive association between attitude and ESIB,  $r = 0.482$ , 95% CI (confidence interval) lower limit (LLCI)/Upper limit (ULCI) =  $0.396/0.559$ ,  $p < .001$ . We observed a non-negligible level of variation in the distribution of effect sizes (Tau =  $0.343$ , Tau-squared =  $0.117$ ). This might be explained by the considerable extent of heterogeneity (i.e.,  $I^2 = 98.84$ ;  $Q(40) = 3458.58$ ,  $p < .0001$ ) inherent among the sampled studies.

To address the extent to which publication bias may have impacted upon the analysis we first examined the classical Rosenthal's (1979) fail-safe N. This index estimates how many unpublished studies with a null effect size would be necessary to turn a significant population effect size estimate into a non-significant one based on the Stouffer Z-test. Rosenthal (1979) recommended the fail-safe N to be smaller than a  $5K+10$  benchmark. In our meta-analysis, for the relationship between attitude and ESIB, the critical values  $5K+10$  was 215. Statistical analyses showed such a  $Nfs = 75246$ . Moreover, we inspected the so-called "funnel plot", that is a graphical technique in which the standard error of each study's effect size is plotted against the standardized effect size itself. Lack of publication bias is demonstrated by a symmetrical cloud of studies centred around the population effect size, with increasing variability at increasing levels of standard error. This is because there should be about as many studies providing non-significant results as those providing significant ones at each specific level of standard error, whereas studies with smaller standard errors should also be closer to the population effect size. As shown in the Figure 3.1 the funnel plot was about symmetrical. In sum, both of these indicators suggest that the present analysis is not contaminated by publication bias.

#### 3.4.2.2 Moderation results

In the analysis of this and all other individual level predictors we used the percentage of women in the sample as a continuous variable to be included in the meta-regression model that aims to estimate the potential moderating effect of gender in the relationship between the independent variable (i.e., ecological attitude in this case) and ESIB. Results show no significant moderating effect of gender ( $\beta = 0.001$ ,  $p = ns$ ). A similar meta-regression model was conducted, considering participants' age as moderator in the relationship between ecological attitude and ESIB. Results show no significant moderating effect of age in the relationship between ecological attitude and ESIB ( $\beta = 0.001$ ,  $p = ns$ ). Concerning the different typology of sample (i.e., students vs. non-students vs. representative sample; see the previous section), results did not show a significant moderating role of this factor,  $Q(1) = 0.014$ ,  $p = ns$ . With regard to the technological focus of the studies (i.e., Focus: 1 = smart energy technology, 2 = electric mobility, 3 = energy in buildings, see coding section for more details), results did also not show a significant moderating role of this factor,  $Q(2) = 0.81$ ,  $p = ns$ . By contrast, results showed a significant moderating role of the type of dependent variable in the relationship between ecological attitude and ESIB. Associations were significant in the case of studies that considered both intention ( $r = 0.565$ , LLCI/ULCI =  $0.475/0.643$ ) and self-reported behaviour as outcomes ( $r = 0.312$ , LLCI/ULCI =  $0.147/0.460$ ). On the contrary, the association with attitude was not significant in the case of studies that considered actual behaviour as outcome ( $r = 0.338$ , LLCI/ULCI =  $-0.099/0.666$ ),  $Q(2) = 9.03$ ,  $p < 0.01$ . Moreover, results showed that the effect size of the association between attitudes and intention ( $r = 0.565$ , LLCI/ULCI =  $0.475/0.643$ ) is significantly larger than the effect size of the association between attitudes and self-reported behaviour ( $r = 0.312$ , LLCI/ULCI =  $0.147/0.460$ ),  $Q(1) = 8.40$ ,  $p < 0.01$ .

**Table 3.1. Summary of ES of the relationship between ecological attitude and energy saving intention/behaviour.**

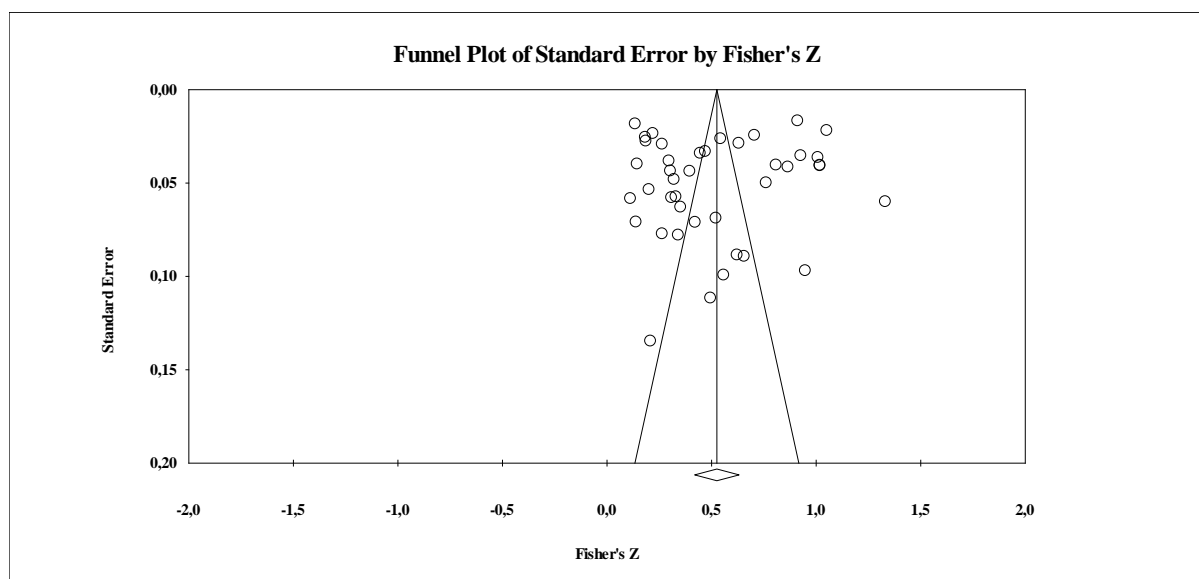
Studies & Year	Statistics for each study			
	Sample Size	Correlation	95%LLCI	95%ULCI
1 Afroz et al., 2015 (ESPR Journal)	350	0,20	0,10	0,30
2 Aini et al., 2013	201	0,14	0,00	0,27
3 Al Amin et al., 2016	300	0,30	0,19	0,40
4 Barbarossa et al., 2015 a	611	0,67	0,62	0,71
5 Barbarossa et al., 2015 b	600	0,77	0,74	0,80
6 Barbarossa et al., 2015 c	794	0,73	0,70	0,76
7 Carmi et al., 2015	1160	0,26	0,21	0,31
8 Claudy et al., 2013	254	0,34	0,23	0,44
9 Craig et al., 2014	2058	0,78	0,77	0,80
10 Degirmenci et al., 2017	167	0,33	0,19	0,46
11 Dixon et al., 2015	2919	0,14	0,10	0,17
12 Engelken et al., 2016	109	0,74	0,64	0,81
13 Fornara et al., 2016	432	0,31	0,22	0,39
14 Gaspar et al., 2011	1303	0,19	0,13	0,24
15 Halder et al., 2016 a	402	0,64	0,58	0,70
16 Halder et al., 2016 b	130	0,55	0,42	0,66
17 Han et al., 2017	607	0,77	0,74	0,80
18 Hansla et al., 2008	855	0,42	0,36	0,47
19 Hatzl et al., 2014	58	0,21	-0,05	0,44
20 Hertel et al., 2016	104	0,51	0,35	0,64
21 Kim et al., 2014	1647	0,61	0,58	0,64
22 Klöckner et al., 2013	1787	0,22	0,17	0,26
23 Korcaj et al., 2015	200	0,40	0,28	0,51
24 Lin et al., 2016	305	0,32	0,22	0,42
25 Litvine et al., 2011	170	0,26	0,11	0,40
26 Mohamed al., 2016	3505	0,72	0,71	0,74
27 Moons et al., 2012	1199	0,56	0,52	0,60
28 Murtagh et al., 2013	83	0,46	0,27	0,61
29 Nayum et al., 2014	1517	0,18	0,13	0,23
30 Nguyen et al., 2016	682	0,29	0,22	0,36



31 Park et al., 2014	1429	0,50	0,46	0,54
32 Pettifor et al., 2015	295	0,11	0,00	0,23
33 Prete et al., 2017	128	0,58	0,45	0,68
34 Rai et al., 2017	522	0,38	0,30	0,45
35 Scott et al., 2014	279	0,87	0,84	0,90
36 Shi et al., 2017	580	0,70	0,66	0,74
37 Wittenberg et al., 2016	213	0,48	0,37	0,58
38 Wolske et al., 2017	904	0,44	0,39	0,49
39 Yang et al., 2016	526	0,30	0,22	0,37
40 Yun et al., 2015	753	0,77	0,73	0,79
41 Zierler et al., 2017	628	0,15	0,07	0,22

**Note.** A 95% CI that does not include zero provides evidence of a significant effect.

**Figure 3.1. Funnel plot of the relationship between ecological attitude and energy saving intention/behaviour.**



### 3.4.3 Awareness of Consequences, Climate Change and Energy Saving Intention/Behaviour

#### 3.4.3.1 Overall and publication bias results

The list of effect sizes of the association between awareness of consequences/beliefs in climate change and energy saving behaviours/intentions (ESIB) are displayed in Table 3.2. The analysis revealed a moderate positive association between awareness of consequences/beliefs in climate change and ESIB:  $r = 0.311$ , 95% CI LLCI/ULCI = 0.241/0.379,  $p < .001$ . We observed a non-negligible level of variation in the distribution of effect sizes (Tau = 0.209, Tau-squared = 0.044). This might be explained by the considerable extent of heterogeneity (i.e.,  $I^2 = 97.51$ ;  $Q(29) = 1168.14$ ,  $p < .0001$ ) across the sampled studies.

In the current meta-analysis, for the relationship between awareness of consequences/beliefs in climate change and ESIB, the critical values 5K+10 of Nfs was 160. Statistical analyses showed such a Nfs = 8803. As showed in the Figure 3.2 the funnel plot reveals an almost symmetrical distribution. In sum, both of these indicators suggest that the present analysis is not likely to be contaminated by publication bias.

#### 3.4.3.2 Sensitivity Analysis

The variable “beliefs in climate change” could be considered as a sub-category of the more general concept of “awareness of consequences”, which focus on a specific dimension of ecological consequences (i.e., climate change). Therefore, through a sensitivity analysis, we explored whether the effect size in the index of association that was derived from a pure measure of awareness of consequences ( $r = 0.333$ , LLCI/ULCI = 0.255/ 0.407) is different from the effect size derived from a measure of beliefs in climate change ( $r = 0.223$ , LLCI/ULCI = 0.057/0.378). While both effects were significant, they were not significantly different from each other,  $Q(1) = 1.512$ ,  $p = .219$ . Thus, we can conclude that the overall effect size of the relationship between this predictor and ESIB is not affected from specific measurement features used to assess either awareness of consequences or beliefs in climate change.

#### 3.4.3.3 Moderation Results

The results reveal no significant moderating effects by gender ( $\beta = -0.001$ ,  $p = .ns$ ) and age ( $\beta = 0.001$ ,  $p = .ns$ ) in the relationship between awareness of consequences/beliefs in climate change and ESIB. For what it concerns the sample typology, again results did not show a significant moderating effect:  $Q(1) = 0.70$ ,  $p = ns$ . Non-significant effects were also showed from both the technological focus of the study ( $Q(3) = 3.09$ ,  $p = ns$ ) and the type of dependent variable ( $Q(2) = 0.08$ ,  $p = ns$ ).

**Table 3.2: Summary of ES of the relationship between awareness of consequences/beliefs in climate change and energy saving intention/behaviour.**

Studies & Year	Statistics for each study			
	Sample Size	Correlation	95%LLCI	95%ULCI
1 Afroz et al., 2015 (Euasia Journal)	200	0,06	-0,08	0,19
2 Alam et al., 2014	200	0,41	0,28	0,52
3 Barbarossa et al., 2015 a	611	0,48	0,42	0,54
4 Barbarossa et al., 2015 b	600	0,48	0,42	0,54
5 Barbarossa et al., 2015 c	794	0,31	0,25	0,37
6 Barbarossa et al., 2017	2005	0,50	0,47	0,53

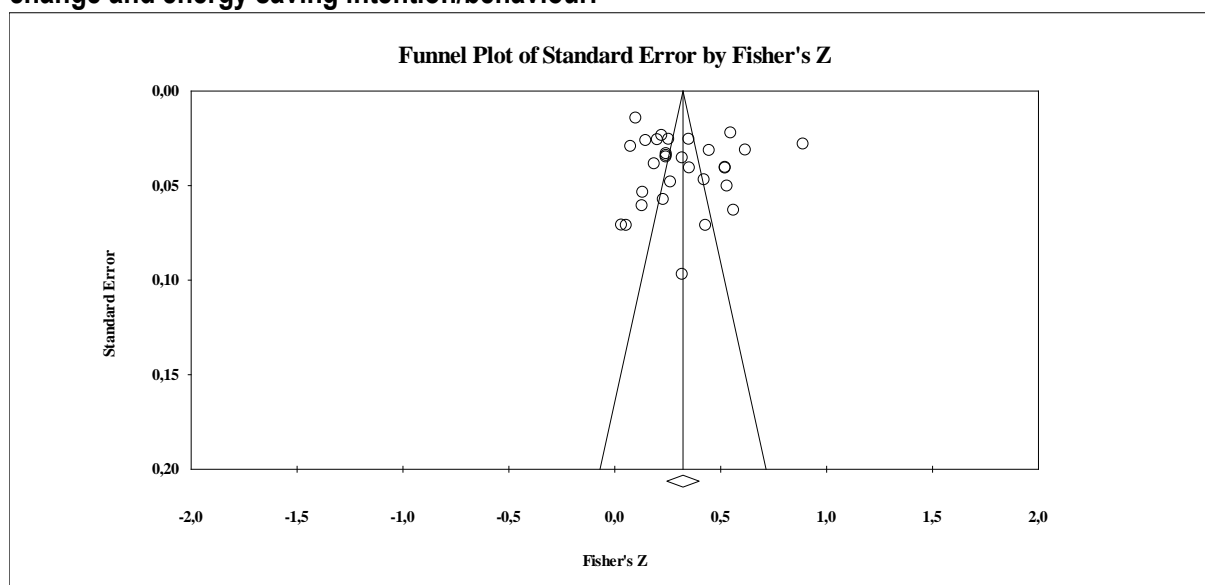


7 Bichard et al., 2012	671	0,19	0,11	0,26
8 Engelken et al., 2016	109	0,31	0,13	0,47
9 Fornara et al., 2016	432	0,26	0,17	0,34
10 Gerpott et al., 2013	453	0,40	0,32	0,47
11 Hansla et al., 2008	855	0,24	0,17	0,30
12 He et al., 2017	396	0,49	0,41	0,56
13 Hobman et al., 2014	1154	0,08	0,02	0,13
14 Karytsas et al., 2014	201	0,03	-0,11	0,17
15 Klöckner et al., 2013	1787	0,22	0,18	0,26
16 Lillemo et al., 2014	1004	0,42	0,37	0,47
17 Lin et al., 2016	305	0,23	0,12	0,33
18 Menon et al., 2016	1017	0,55	0,51	0,59
19 Nakada et al., 2016	4750	0,10	0,07	0,13
20 Nayum et al., 2014	1517	0,25	0,20	0,30
21 Sapci et al., 2014	602	0,34	0,27	0,41
22 Spence et al., 2010	1491	0,20	0,15	0,25
23 Tsagarakis et al., 2011	1440	0,15	0,10	0,20
24 Vaccaro et al., 2010	1257	0,71	0,68	0,74
25 Wang et al., 2011	816	0,24	0,17	0,30
26 Wang et al., 2017	253	0,51	0,41	0,60
27 Wolske et al., 2017	904	0,24	0,18	0,30
28 Xiaogu et al., 2013	1516	0,34	0,29	0,38
29 Zhang X et al., 2013	349	0,13	0,03	0,23
30 Zhang Y et al., 2013	273	0,13	0,01	0,24

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**Note.** A 95% CI that does not include zero provides evidence of a significant effect.

**Figure 3.2. Funnel plot of the relationship between awareness of consequences/beliefs in climate change and energy saving intention/behaviour.**



### 3.4.4 Emotion and Energy Saving Intention/Behaviour

#### 3.4.4.1 Overall and publication bias results

As the number of studies investigating the relationship between each single emotion (e.g., pride, guilt or anger) and ESIB was small, we pooled all of these emotions together and we considered such emotions as drivers of ESIB. This was possible because, independently from emotional valence, each study considered these emotions as drivers of ecological behaviour. The list of effect sizes of the association between emotions and ESIB are contained in Table 3.3. The analysis revealed a large positive association between such emotions (e.g., guilt, pride, etc.) and ESIB,  $r = 0.533$ , 95% CI LLCI/ULCI = 0.379/0.658,  $p < .0001$ . We observed a non-negligible level of variation in the distribution of effect sizes (Tau = 0.276, Tau-squared = 0.076). This might be explained by the considerable extent of heterogeneity (i.e.,  $I^2 = 97.49$ ;  $Q(7) = 279.62$ ,  $p < .0001$ ) inherent among the sampled studies.

In the current meta-analysis, for the relationship between emotions and ESIB, the critical values  $5K+10$  of Nfs was 50. Statistical analyses showed such a Nfs = 2357. As showed in the Figure 3.3 the funnel plot was about symmetrical. In sum, both of these indicators suggest that the present analysis is not contaminated by publication bias.

#### 3.4.4.2 Moderation results

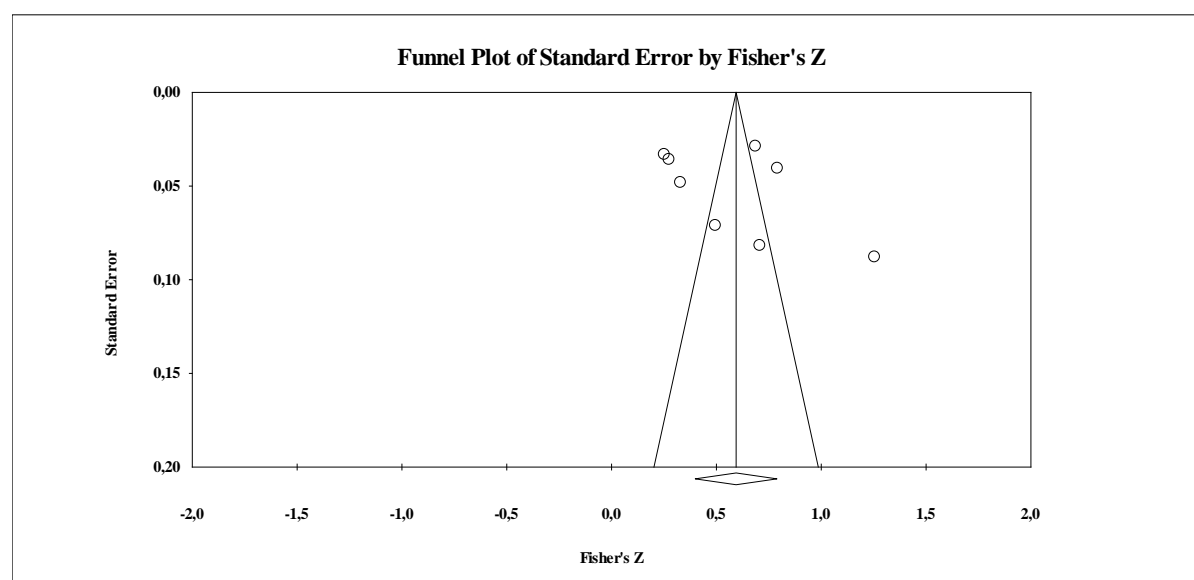
The results demonstrated a significant moderating effect by gender ( $\beta = -0.03$ ,  $p < 0.001$ ;  $R^2$  analog = 0.60), with the effect approaching zero when increasing the percentage of women (See Figure 3.4). Moreover, the results also showed a significant moderating effect by age ( $\beta = -0.02$ ,  $p < 0.05$ ;  $R^2$  analog = 0.59), with the effect approaching zero when increasing participants' age (See Figure 3.5). With regard to the type of the sample, results did not show a significant moderating role of this factor,  $Q(1) = 0.176$ ,  $p = ns$ . Non-significant effects were also showed by both technological focus of the study ( $Q(2) = 2.16$ ,  $p = ns$ ) and type of dependent variable ( $Q(1) = 0.124$ ,  $p = ns$ ).

**Table 3.3. Summary of ES of the relationship between emotions and energy saving intention/behaviour.**

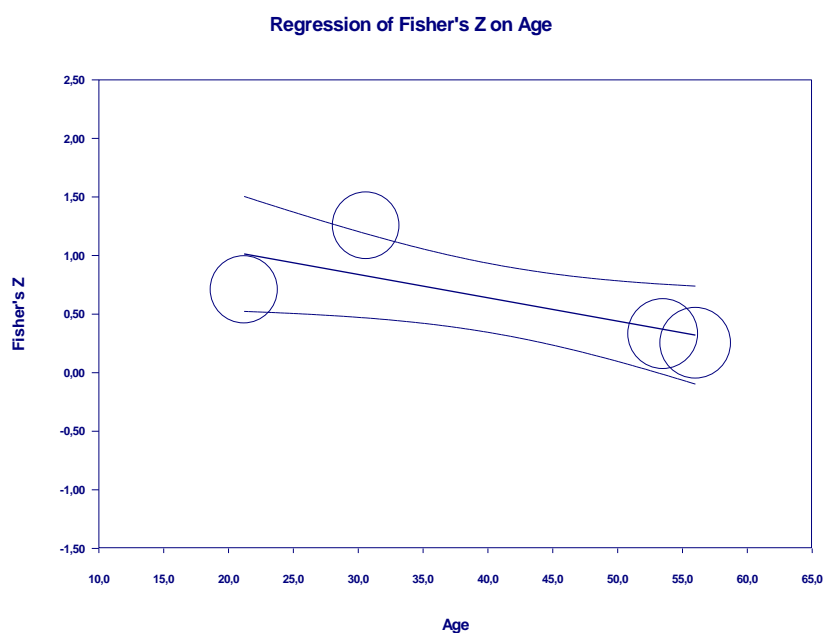
Studies & Year	Statistics for each study			
	Sample Size	Correlation	95%LLCI	95%ULCI
1 Fornara et al., 2016	432	0,32	0,23	0,40
2 Han et al., 2017	607	0,66	0,61	0,70
3 Moons et al., 2012	1199	0,60	0,56	0,63
4 Taufik et al., 2016a	152	0,61	0,50	0,70
5 Taufik et al., 2016b	132	0,85	0,79	0,89
6 Wang et al., 2016	775	0,27	0,20	0,33
7 Webb et al., 2013	200	0,46	0,34	0,56
8 Wolske et al. 2017	904	0,25	0,19	0,31

**Note.** A 95% CI that does not include zero provides evidence of a significant effect.

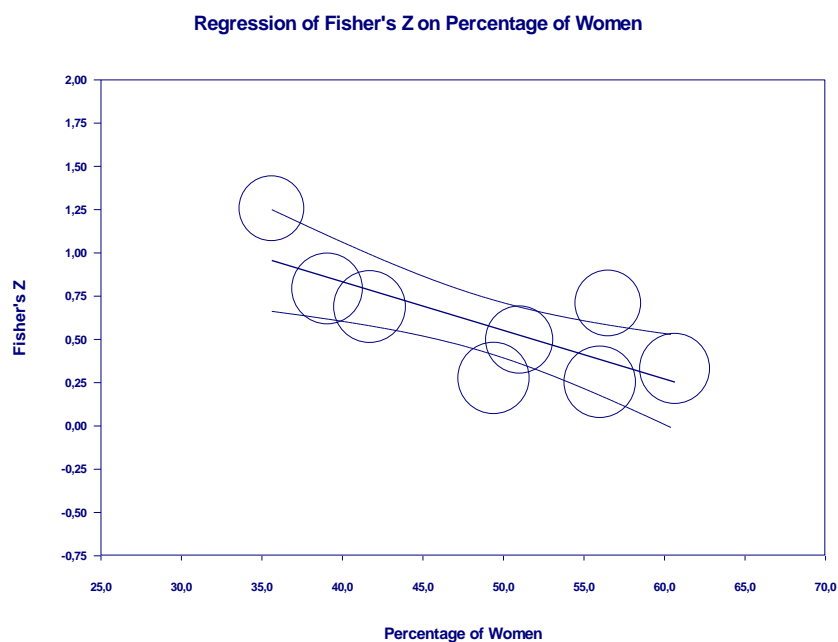
**Figure 3.3. Funnel plot of the relationship between emotions and energy saving intention/behaviour**



**Figure 3.4. Difference in the association between emotion and energy-saving intention/behaviour as a function of age.**



**Figure 3.5. Difference in the association between emotion and energy-saving intention/behaviour as a function of gender.**



### 3.4.5 Pro-environmental Value and Energy Saving Intention/Behaviour

#### 3.4.5.1 Overall and publication bias results

The list of effect sizes of the association between pro-environmental value and ESIB are displayed in Table 3.4. The analysis revealed a small/moderate positive association between pro-environmental value and ESIB,  $r = 0.271$ , 95% CI LLCI/ULCI = 0.193/0.346,  $p < .0001$ . We observed a non-negligible level of variation in the distribution of effect sizes (Tau = 0.096, Tau-squared = 0.009). This might be explained by the moderate/large extent of heterogeneity (i.e.,  $I^2 = 86.94$ ;  $Q(6) = 45.94$ ,  $p < .0001$ ) emerging among the sampled studies.

In the current meta-analysis, for the relationship between pro-environmental value and ESIB, the critical values 5K+10 of Nfs was 45. Statistical analyses showed such a Nfs = 715. As showed in the Figure 3.6 the funnel plot was about symmetrical. In sum, both of these indicators suggest that the present analysis is not contaminated by publication bias.

#### 3.4.5.2 Moderator Results

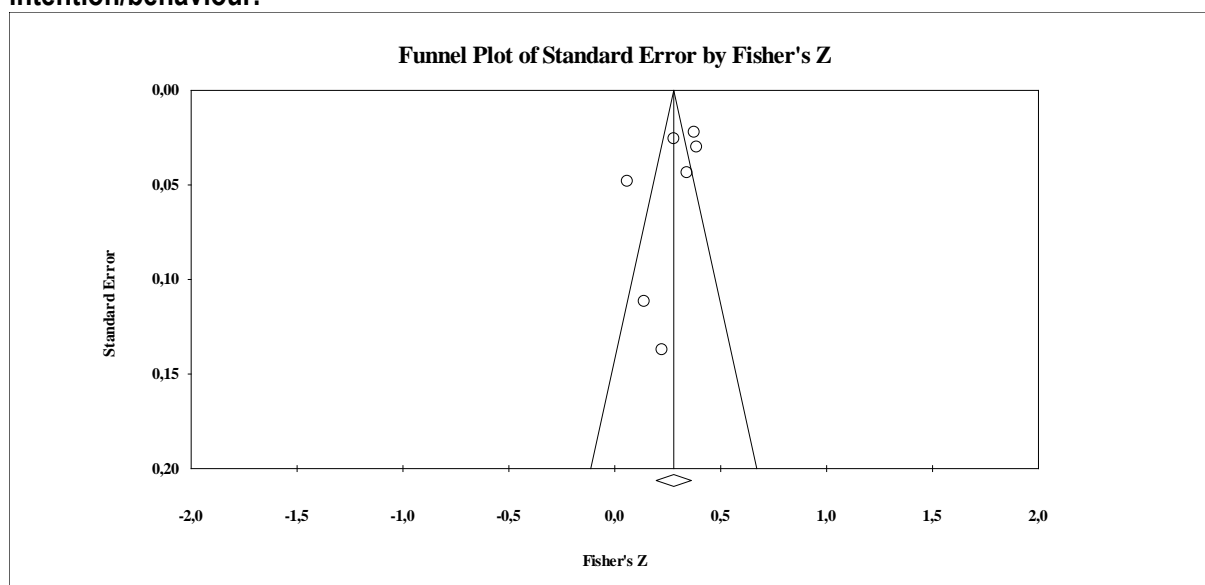
The results reveal no significant moderating effect by gender ( $\beta = -0.002$ ,  $p = ns$ ), whereas a significant moderating effect of age was detected ( $\beta = -0.02$ ,  $p < 0.05$ ;  $R^2$  analogue = 0.59), with the effect approaching zero when participants' age increases (See Figure 3.7). With regard to the type of the sample, results did not show a significant moderating role of this factor,  $Q(1) = 1.25$ ,  $p = ns$ . Non-significant moderation effects were detected also in the case of the technological focus of the study ( $Q(2) = 3.35$ ,  $p = ns$ ) and type of dependent variable ( $Q(2) = 0.79$ ,  $p = ns$ ).

**Table 3.4. Summary of ES of the relationship between pro-environmental value and energy saving intention/behaviour.**

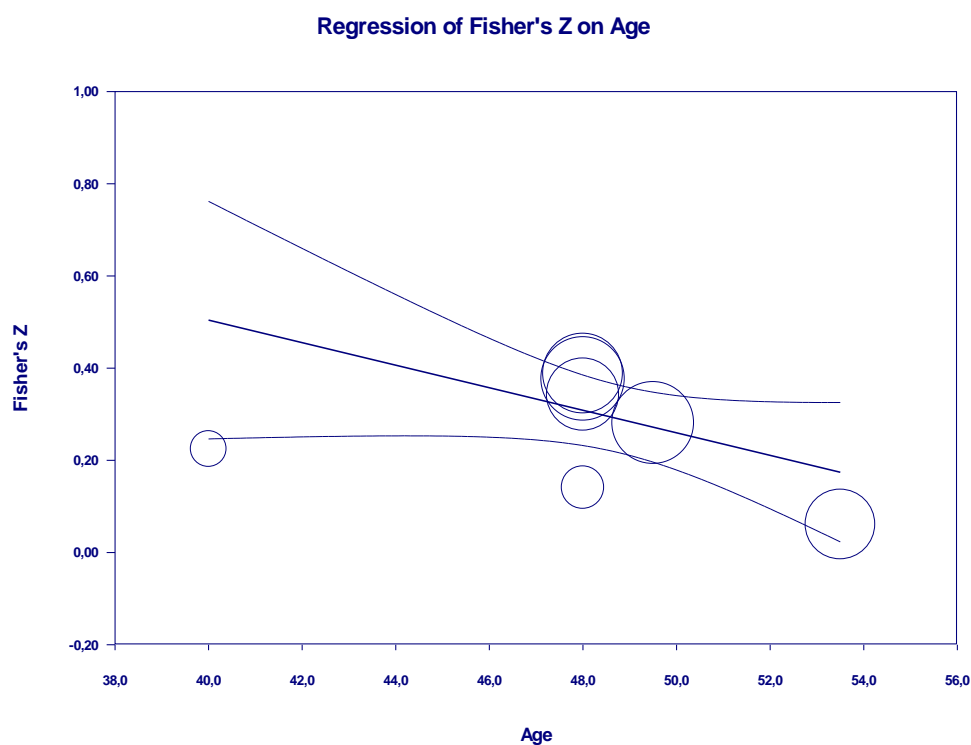
Studies & Year	Statistics for each study			
	Sample Size	Correlation	95%LLCI	95%ULCI
1 Barbarossa et al., 2017	2005	0,36	0,32	0,40
2 Fornara et al., 2016	432	0,06	-0,03	0,15
3 Girod et al., 2017	1101	0,37	0,32	0,42
4 Hatzl et al., 2014	56	0,22	-0,04	0,46
5 Murtagh et al., 2013	83	0,14	-0,08	0,35
6 Nayum et al., 2016	1508	0,27	0,23	0,32
7 Yang et al., 2016	526	0,33	0,25	0,40

**Note.** A 95% CI that does not include zero provides evidence of a significant effect.

**Figure 3.6. Funnel plot of the relationship between ecological value and energy saving intention/behaviour.**



**Figure 3.7. Difference in the association between pro-environmental value and energy-saving intention/behaviour as a function of age**



### 3.4.6 Intention and Energy Saving Behaviour

#### 3.4.6.1 Overall and publication bias results

As stated earlier, to assess the role of behavioural intentions to adopt energy saving solutions as a predictor variable in the current meta-analysis, we considered only those studies that measured actual or self-reported ESBs as outcomes. The list of effect sizes of the association between intention to adopt energy saving solutions and ESB are displayed in Table 3.5. The analysis revealed a moderate positive association between intention and ESB,  $r = 0.300$ , 95% CI LLCI/ULCI = 0.249/0.350,  $p < .0001$ . We observed a non-negligible level of variation in the distribution of effect sizes (Tau = 0.096, Tau-squared = 0.009). This might be explained by the moderate/large extent of heterogeneity (i.e.,  $I^2 = 84.65$ ;  $Q(15) = 97.76$ ,  $p < .0001$ ) emerging among the sampled studies.

In the current meta-analysis, for the relationship between intention to adopt energy saving solutions and ESB, the critical values 5K+10 of Nfs was 90. Statistical analyses showed such a Nfs = 2925. As showed in the Figure 3.8 the funnel plot was about symmetrical. In sum, both of these indicators suggest that the present analysis is not contaminated by publication bias.

#### 3.4.6.2 Moderation Results

The results demonstrated no significant moderating effect by gender ( $\beta = 0.001$ ,  $p = ns$ ) and age ( $\beta = -0.003$ ,  $p = ns$ ) in the relationship between intention to adopt energy saving solutions and ESB. With regard to the type of the sample, results showed a significant moderating role of this factor:  $Q(1) = 4.55$ ,  $p < 0.01$ . Although associations were significant for both non-student ( $r = 0.274$ , LLCI/ULCI = 0.214/0.333) and student samples ( $r = 0.421$ , LLCI/ULCI = 0.300/0.529), the effect size in the case of student samples was significantly larger. Non-significant effects were shown for the moderation analysis on both the technological focus of the study ( $Q(2) = 0.351$ ,  $p = ns$ ) and the type of dependent variable ( $Q(1) = 0.61$ ,  $p = ns$ ).

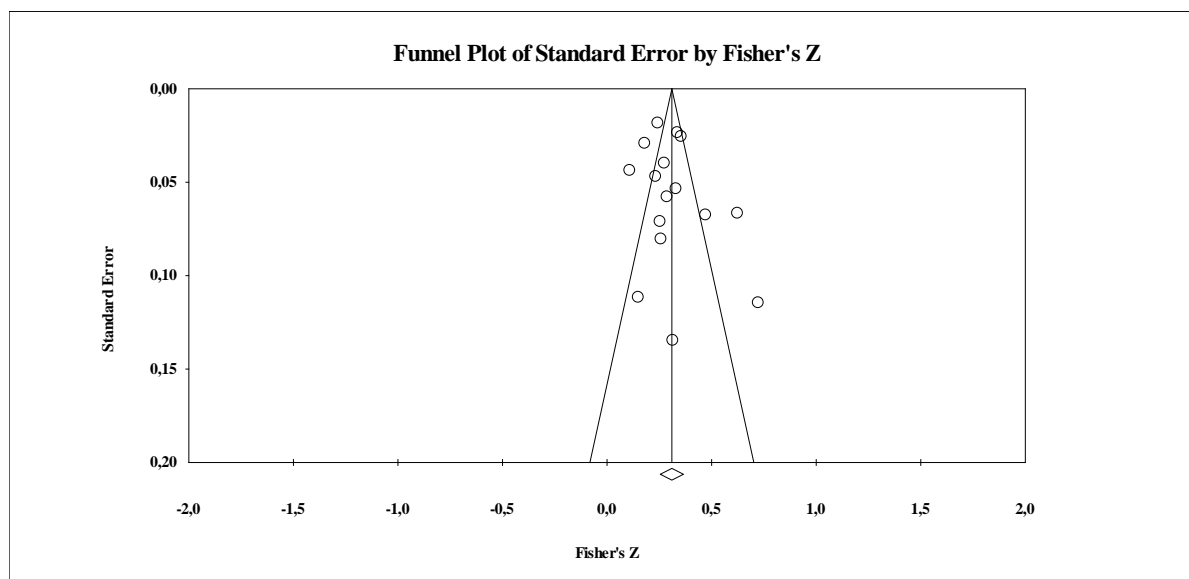
**Table 3.5. Summary of ES of the relationship between intention to adopt energy saving solutions and energy saving behaviour.**

Studies & Year	Statistics for each study			
	Sample Size	Correlation	95%LLCI	95%ULCI
1 Afroz et al., 2015 (ESPR Journal)	350	0,32	0,22	0,41
2 Ajzen et al., 2011	79	0,62	0,46	0,74
3 Akman et al., 2015	157	0,25	0,10	0,39
4 Al-Amin et al., 2016	300	0,28	0,17	0,38
5 Azar et al., 2017	227	0,56	0,46	0,64
6 Carmi et al., 2015	1160	0,18	0,12	0,24
7 Dixon et al., 2015	2919	0,24	0,21	0,27
8 Gerpoirt et al., 2013	453	0,23	0,14	0,32
9 Hatzl et al., 2014	58	0,31	0,05	0,52
10 Khorasanizadeh et al., 2016	221	0,44	0,33	0,54
11 Klöckner et al., 2013	1787	0,33	0,28	0,37
12 Murtagh et al., 2013	83	0,15	-0,07	0,35
13 Nayum et al., 2014	1517	0,34	0,30	0,39
14 Rai et al., 2017	522	0,11	0,02	0,19

15 Webb D et al., 2013	200	0,25	0,12	0,38
16 Zierler et al., 2017	628	0,27	0,19	0,34

**Note.** A 95% CI that does not include zero provides evidence of a significant effect.

**Figure 3.8. Funnel plot of the relationship between intention to adopt energy saving solutions and energy saving behaviour.**



### 3.5 Conclusions, limitations and directions for future research

Taken together, the results of our meta-analyses show a consistent association between different classes of individual psychological determinants (namely, attitudes, intentions, values, awareness and emotions) on the one hand, and energy-saving behaviours or behavioural intentions on the other hand. All the predictors considered in the current meta-analysis showed significant positive associations with the outcome. However, some limitations shall be mentioned. For example, results concerning pro-environmental emotions and values are based on 8 and 7 studies, respectively. Thus, our work suggests that these factors might be under-investigated, and more research should be done to shed light on this topic, especially in the case of emotions, that seem to be the factor having the largest effect size. Emotions are a motivational driver of human behaviour, and could thus be considered as a relevant tool to leverage people's transition to more sustainable energy saving decisions. Interestingly, the moderation analyses show that other variables may interact with individual-level factors in predicting energy-related behaviour.

Moderation analyses also indicated interesting results. More specifically, participants' age represents a relevant moderator in both the links between pro-environmental values and emotions on the one hand, and intention/behaviour on the other: these relationships are weaker among older people. Concerning participants' gender, the association between emotions and energy-related behaviour is weaker among women than men. Moreover, the typology of the sample recruited (e.g., student vs non-student) moderates the relationship between intention and behaviour, with students showing a greater effect size than non-students. Finally, results show that the effect size of attitudes is moderated by the type of outcome measure considered in the studies. In fact, the relationship between attitude and behaviour is not statistically significant when the outcome of the study is the



actual behaviour (e.g., actual electricity consumption measured in Kwh). Also, a different strength of the association with attitudes emerged across intention to adopt energy saving solutions and self-reported behaviour, with a larger effect size in the case of intentions, compared to self-reported behaviour.

Taken together all of these results can have relevant applied implications for both academics and policy makers, as they can provide guidelines to design future studies as well as to tailor specific policies and campaigns.

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## 4 GENERAL DISCUSSION

### 4.1 Identity and emotions as novel causal factors

The purpose of the two meta-analyses present in this report is to provide insights and advance our knowledge on the individual and collective psychological drivers of pro-environmental behaviours and energy-saving choices.

The two sets of meta-analyses represent a significant advance for both the explanation of private sustainable energy action and for extending general psychological models of pro-environmental action. That is, we not just considered traditional attitude and personal belief predictors of pro-environmental action and intentions, as they have been included in already validated general models, such as those by Klöckner (2014) or Bamberg and Möser (2005). Instead, we extended earlier taxonomies by the concepts of identity and emotion and provide the first systematic meta-analytical tests of the effects of identity-related variables and emotions on pro-environmental action in general and energy-saving behaviour in particular. We find positive effects of most identity-related and individual level variables (including emotions) on people's pro-environmental and energy-saving behaviour, respectively. These novel results suggest the opportunity to extend intervention programs and policy decisions to foster the self-relevance of environmental issues for individuals and collectives, and to associate pro-environmental action with supportive emotional experiences.

We also learned that there is still work ahead to identify specific processes and boundary conditions that are relevant for identity and emotion to foster people's pro-environmental behaviour and, of particular importance for the purpose of ECHOES, sustainable energy action. In this vein, it is important to note that some parts of the novel meta-analytical findings on identity and emotions rest on a comparatively small number of empirical studies. This is why we extended our analysis of identity effects beyond energy behaviour to pro-environmental intentions and behaviour in general. However, given that people identify sustainable energy behaviour as pro-environmental action, the results should be generalizable to our specific field of interest. For our analyses on individual level variables, we considered a broad range of relevant predictors of energy-saving behaviours (i.e., ecological attitudes, pro-environmental values, awareness of consequences, beliefs in climate change, emotions, and intentions to adopt energy saving solutions). In the case of emotions in particular, we also used a different strategy to cope with the low number of studies. While restricting our analysis to energy intentions and behaviour, we pooled across very different kinds of "pro-environmental" emotions, ranging from negative emotions, such as guilt or anger, to positive ones, such as pride. Clearly, future research is needed to distinguish the specific effects and processes each of these emotions may trigger.

The distinction between sub-concepts has been possible for identity effects, allowing for a clearer picture of what kind of environmentally relevant identity aspects seem relevant for determining people's everyday pro-environmental conduct. Here, the most important distinction can be made between personal and social identity factors. On the ground of our results, people who define their personal self via pro-environmental attitudes and nature as such, are often those who also report and show high levels of pro-environmental behaviour (medium-sized effect). This effect is less clear for place identity. It seems that personal attachment to a specific place, such as the local environment, is not sufficient to induce increased intention to act in a pro-environmental manner. It may rather need people to perceive the natural aspects of their place to be endangered, to associate place with nature at all, or not to perceive specific environmental policies in contrast to local place welfare, to find place identity predicting pro-environmental intentions.

Pro-environmental identities may represent a short-cut to pro-environmental action that circumvents situation-specific rational decision-making. Just being "the type of person" who protects the environment should determine



a general inclination to act in a pro-environmental manner, which is independent of specific realistic costs and benefits people expect a specific action (e.g., investing money in properly insulating one's own home) to have. Instead, those people should perform sustainable energy behaviour as an expression of their self. Supporting the personal identification with nature and environmental protection should thus be supported from early on, for instance, in formal or informal education. Also, to further elucidate the specific role personal identity plays for fostering sustainable energy behaviour, future studies will have to clearly tease apart identity and attitude effects (e.g., Fritsche et al., in press). Also, many studies do not clearly distinguish between the effects of personal identity and social identity. However, this distinction is important for understanding whether pro-environmental identities work on a merely personal level or whether pro-environmental identities need to be collective in order to become relevant for action.

As single individuals, people are neither capable to effectively target large-scale environmental crises, such as climate change or air-pollution, nor would individual action be rational, given that others may not contribute as well (Fritsche et al., in press). The situation is different when people perceive pro-environmental attitudes, intentions, and actions to be shared among members of large ingroups, such as the citizens of their city, their country, or the entire earth. Such groups are relevant actors to address environmental crises and to realize large-scale transitions, for instance, to green energy. This is why social identities should be of premier importance for whether or not individuals feel it is appropriate to act on behalf of such large-scale projects in their everyday life. Indeed, the few data sets we found to meta-analytically test the effects of social identity quite consistently show a robust effect of ingroup identification on pro-environmental intentions and behaviour. Of course, people do not consider all of their ingroups to be primarily associated with shared pro-environmental goals. This is why the overall effect of social identity is only of small to medium size. However, of importance, taking into account the normative nature of the group suggests a medium to strong effect on pro-environmental action when the ingroup is associated with pro-environmental norms. More experimental studies are needed that explicitly test the interactive effect of ingroup identification and norms (e.g., Masson & Fritsche, 2014). Even more so, in line with a novel Social Identity Model of Pro-Environmental Action (Fritsche et al., in press), developed within ECHOES, it seems warranted to explicitly test the facilitating and inhibiting conditions of positive social identity effects on pro-environmental action, and on sustainable energy use in particular, such as ingroup norms and collective efficacy beliefs. This will uncover not just the policy potential of social identity effects but will also inform about which intra- and intergroup dynamics (e.g., a sense of collective coordination, intergroup competition) are important for efficacious pro-environmental collective identities to emerge.

Early socialization of pro-environmental belief structures might be a policy goal of primary importance. This is indicated by differential effects across age groups uncovered in both meta-analyses. Specifically, place identity and pro-environmental values turned out to be more strongly related in samples of younger (than older) people. This might be explained in terms of generation effects. Generations may differ with regard to environmental problem perception and the degree to which they link pro-environmental values with specific pro-environmental behaviour options. That is, whereas younger generations may have learned in the course of their (political) socialization that personally valued places in nature are inherently threatened and potential object of care, this might not be true to the same degree for older generations. At the same time, due to public discourse on environmental action, younger generations may have had a greater chance to learn what can be done to preserve the natural environment, thus being better able than members of older generations to translate general pro-environmental values into relevant action. Although this might just be one among further possible explanation of the moderating effects of participants' age, it suggests that socialization experiences are important for people translating their identities and general values into pro-environmental action intentions. This is important for policy advice as well, stressing, for instance, the necessity of providing formal and informal learning opportunities but also about communicating pro-environmental social norms. These should highlight the connection between valued places and the need to preserve their natural aspects (not just "think global, act local", but also "think local, act local"). Furthermore, it should be worthwhile to pronounce the innate relation between general environmental values and concrete opportunities to express these values by means of specific pro-environmental action, for instance, in the area of energy saving behaviour. As a further aspect, the moderation of place identity and value effects by age suggests that the latter interventions should not just take place in childhood education but should also address older generations.



Equally interestingly are, in our view, the gender-related variations of the relationship between emotions, considered as a fundamental motivational driver of human behaviour, and energy friendly choices. In particular, the role of emotions in energy saving seem to be stronger among men than women. These findings, combined to the findings of stronger links between identity and pro-environmental behaviours among women compared to men, might have interesting implications for public campaigns and intervention in the energy domain. For example, we might expect men to be more successfully addressed by persuasive appeals or interventions based on behaviour-specific emotional factors, and women to be more sensitive to appeals or interventions based on an overarching social identity focus.

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